

Findings from MEPAG Meeting #37
Caltech, Pasadena, CA
July 26, 2019

This document is posted at: <https://mepag.jpl.nasa.gov/meetings.cfm?expand=m37>.

Format: The findings for the [37th MEPAG face-to-face meeting \(held July 26, 2019\)](#), are given here, divided into two sections. The first section describes new findings or major updates on previous findings. The second section repeats the suggested actions on all the [findings](#) from the [36th MEPAG meeting \(held April 3-5, 2018\)](#); those findings are referenced as in #36-n, where n is the finding number from that meeting.

I. New Findings or Major Updates

1. **Finding:** Mars Sample Return remains the highest priority science goal for the Mars Exploration Program, as described in *Visions & Voyages (V&V)* and as recently endorsed in *Visions into Voyages (ViV)*, the NASEM Midterm report. At the 36th MEPAG Meeting, MEPAG encouraged the Mars Exploration Program (MEP) to maintain the goal of completing lean, science-driven Mars Sample Return in the next decade. NASA is openly and enthusiastically making major progress on planning for Mars Sample Return (MSR), thereby addressing the Decadal Survey's top priority for NASA flagship missions. The definition of a joint ESA-NASA partnership, including the definition of technical responsibilities, is very responsive to the last Decadal Survey's (*V&V*) call for international partnerships to result in a robust plan and reasonable cost for the next steps in returning samples from Mars to Earth.
 - **Relation to prior findings:** The new and visible activity indicates major progress on Finding #36-1.

MEPAG is greatly encouraged by the current progress and stands ready to assist NASA in leveraging these developments to result in the next flight missions needed to implement MSR. This includes providing support for science analysis activities needed before samples arrive on Earth (e.g., sterilization protocols, sample handling procedures, sample context analysis, release policy).

2. **Finding:** As noted in the Decadal Survey and outlined in the MEPAG Goals, the Mars Exploration Program has additional important priorities along with MSR. For example, a recent MEPAG Science Analysis Group report noted the compelling science questions about ice and volatile evolution in the recent geological past (*ICE-SAG*). *ViV* noted that major new science questions have emerged since *V&V* that will not be addressed by MSR, including diversity of ancient habitable environments, Amazonian climate change, and the dynamic nature of present-day Mars. In light of the first-order discoveries that generated these new questions, MEPAG notes the need for identified opportunities for non-MSR flight investigations (orbital or landed). MEPAG is also intrigued by innovative paths to conduct science at Mars that may be possible through commercial partners and smaller missions. Looking forward, MEPAG believes that the MEP should encompass addressing outstanding questions and priorities in Mars science in parallel or beyond the orbiter and rover missions required for sample return.

- Relation to prior findings: MEPAG Findings #36-3, 36-7.

2.1 MEPAG agrees with the mid-term assessment that NASA should develop a comprehensive MEP architecture that addresses the Decadal Survey science goals, and is encouraged that NASA is creating a MEP strategic architecture panel for this purpose. MEPAG stands ready to assist in this effort, including vetting of drafts. In parallel with and after MSR, MEPAG also encourages the consideration of MEP missions in all classes, and funding to support research and analysis of the incredible wealth of data acquired from Mars.

2.2 MEPAG recognizes the combination of limited funding and balancing of priorities that limits the designation of identified missions. MEPAG continues to see possibilities in specific, near-term opportunities for small spacecraft missions and secondary payloads, and commends and encourages NASA's activities in this area. MEPAG also encourages development of missions by NASA in partnership with the commercial sector and/or international partners to address high priority planetary science goals in the Mars system during the era of MSR and afterward.

3. **Finding:** The communication infrastructure necessary to support ongoing orbital science and rover data return is aging (i.e., Odyssey is 18 years in flight, MRO 14 years). MEPAG is encouraged that the MEP has been working to extend the life expectancy of the orbital fleet at Mars, mitigating issues as they arise and adding newer capabilities to the relay network (specifically MAVEN and TGO). Further, the current fleet continues to provide crucial science data utilized to predict or mitigate risk to landed assets from dynamic phenomena such as dust storms. However, issues remain, as the relay burden will only increase given the arrival of Mars 2020 and the other ambitious missions to be launched in the next decade. While the MSR Earth Return Orbiter can support the MSR Sample Retrieval Lander, it will leave Mars orbit once it has captured the orbiting sample cache, potentially leaving no telecommunications and reconnaissance structure at Mars.

- Relation to prior findings: MEPAG Finding #36-4.

MEPAG recommends NASA pursue innovative ways to refresh the orbital relay and reconnaissance capacity at Mars to support ongoing (e.g., Mars 2020) and new landed science and enable both orbital and landed science. This may also be enabling for the future use of small spacecraft and competed missions (e.g., InSight) to study Mars. This issue should be considered by the MEP strategic architecture panel.

4. **Finding:** MEPAG is impressed by the progress of missions in development for 2020 and the early part of the next decade. Many of these are international missions which promise major returns on fundamental science questions, such as the nature of the subsurface, origins of the Mars moons, and full diurnal coverage of atmospheric phenomena.

- Relation to prior findings: MEPAG Finding #36-8.

MEPAG celebrates the many international missions slated to launch and also applauds the progress by the ongoing NASA, ISRO, and ESA Mars Missions, including the recently arrived InSight and Trace Gas Orbiter. We congratulate all those involved in advancing

these missions, and applaud and continue to encourage the deep cooperation across nations and organizations evidenced in these missions.

5. **Finding:** The recommendations in the National Academy of Sciences report on Extended Missions included funding extended missions at roughly constant levels, including adjustments for inflation, as noted in MEPAG Finding #36-4. Since that time, 1) the development cost over-runs of the Mars 2020 rover, as that mission pushes toward launch, have necessitated cuts in many areas including, but not limited to, the ongoing extended Mars missions. 2) Additionally, the FACA-compliant Senior Review process which judged 3-year continuing mission proposals in 2019 remains unfinished. Its budget guidelines have been superseded by year-by-year budget mandates which continue the earlier practice of decreasing budgets with time.

5.1 While MEPAG laments the loss/deferment of science due to cost overruns, we recognize the budget realities and believe it is essential to get Mars 2020 launched without delay.

5.2 The 2019 Senior Review process, whose budget guidelines were more consistent with the NAS report on extended missions, was unable to provide timely input on extended mission priorities into the budget process. MEPAG encourages PSD to examine the Senior Review process and make any possible changes that in the future would allow its results to inform programmatic decisions.

II. Progress or Updates on Prior MEPAG Meeting Findings *(The actions suggested by MEPAG on those Findings are in italics.)*

Finding #36-1: *MEPAG encourages the Mars Exploration Program to maintain the goal of completing lean science-driven Mars Sample Return in the next decade and looks forward to receiving regular reports on progress made in technology development and international partnering.*

- Progress or updates: Significant progress-see Finding #1 above.

Finding #36-2: *MEPAG suggests that NASA give strong consideration to integrated management of the entire multi-mission sample return campaign within the Mars Exploration Program, including scientific oversight to ensure that the scientific value of the returned samples is maintained.*

- Progress or updates: MEPAG is encouraged by the ongoing discussion of the integrated management of the entire multi-mission sample return campaign within the MEP and looks forward to seeing how the scientific oversight needed "to ensure that the scientific value of the returned samples is maintained" is incorporated into that structure. MEPAG stands ready to respond to action items in this area.

Finding #36-3: *MEPAG encourages NASA to explore additional, open-call (competed) opportunities to address high priority planetary science goals in the Mars system during the era of MSR and afterward, in particular, those objectives that have long strategic lead times for the future exploration of Mars.*

- Progress or updates: The MEP strategic architecture panel being formed is chartered to address the potential desire for mission opportunities in their charge to define a long-term Mars Exploration Program architecture, including evaluations of future mission and research opportunities alongside MSR. See Finding #2.

Finding #36-4: *MEPAG encourages that NASA adhere to the recommendations in the National Academy of Sciences report on Extended Missions and continue to fund extended missions at roughly constant levels, including adjustments for inflation.*

- Progress or updates: See Finding #5.

Finding #36-5: *MEPAG encourages that the Science Mission Directorate review interpretations of security recommendations that may overly restrict the ability of international partners to fully carry out their agreed-upon responsibilities in mission development, operations, and data analysis while maintaining appropriate security.*

- Progress or updates: No action on this finding was reported.

Finding #36-6: *MEPAG recommends that R&A resources be incrementally increased in advance of a next decade of fewer non-MSR missions in order to exploit the rich value of the vast volumes of data already returned, and to ensure a critical core of expertise remains available to carry out associated science investigations and plan future missions to Mars, whether robotic or human.*

- Progress or updates: No action on this finding was reported.

Finding #36-7: *MEPAG encourages NASA to continue to support small spacecraft concept studies to help investigate engineering capabilities/challenges, coupled with science objectives and requirements. MEPAG also encourages identification of specific, near-term opportunities for small spacecraft missions/secondary payloads, and to the development by NASA with the commercial sector of technologies and infrastructure necessary to minimize the burden on individual missions for interplanetary propulsion and back-to-Earth telecommunication.*

- Progress or updates: Mars Strategic Architecture panel being formed-see MEPAG #36-3, and Findings #2 and #3 in Section I.

Finding #36-8: *MEPAG congratulates these teams [Mars Express, TGO and ExoMars RSP, UAE Hope, ISRO's MOM, and the JAXA MMX] and their sponsors on the progress to date and looks forward to the data acquisition and analysis enabled by these missions and to the discoveries sure to come.*

- Progress or updates: see Finding #4 in Section I.

Finding #36-9: *MEPAG agrees with the CAPS recommendation that a suite of studies be prepared in advance of the next Planetary Decadal Survey. Among these were: (1) new cost and technical evaluations of the next elements of the sample-return campaign, and (2) analysis of medium-class missions to explore ancient and modern aqueous environments]. MEPAG stands ready to work with NASA to provide assistance to complete these studies in a timely and efficient manner.*

- Progress or updates:

- On (1), NASA and ESA have made considerable progress on studies of the next flight elements for MSR-see Finding #1.
- On (2), NASA released a call for [Planetary Mission Concept Studies](#). MEPAG worked to facilitate the Mars community in their response to that call, including (a) completing the Ice and Climate Evolution Science Analysis Group ([ICE-SAG](#)) report, with a posting of a pre-publication copy of the report; and (b) creation of a google-docs process to facilitate community exchange of ideas and collaboration.

Finding #36-10: MEPAG encourages interaction between the Mapping and Planetary Spatial Infrastructure Team (MAPSIT) and all Analysis/Assessment Groups (AGs) to help prioritize the products in most need of oversight and fabrication to achieve their exploration and analysis goals. MEPAG will strive to do its part, but wishes to understand how priorities can be set consistently across the program.

- Progress or updates: There is as yet no clear movement on this recommendation. However, MAPSIT members have been made aware of the upcoming Goals revision and it is hoped there can be fruitful communication between MEPAG and MAPSIT.