

Summary of the presentations, discussion, and main outcomes of the 37th MEPAG meeting

July 26th, 2019, 8:15AM-1:00PM PDT
at Caltech, Pasadena, CA, USA

UPDATED August 22, 2019 (original Summary was posted August 13, 2019) – to fix a few typos and to fix the expected date for the next NF call (→ October 2022, confirmed by Curt Niebur, NASA lead program scientist for New Frontiers)

Posted agenda and presentation files: <https://mepag.jpl.nasa.gov/meetings.cfm?expand=m37>

Notes present an overview of discussion as well as presentation materials.

General MEPAG Announcements

- Please respond to all requests for general or meeting-specific MEPAG feedback via the email MEPAGmeetingOs@jpl.nasa.gov.
- Potential “Big Questions” in Planetary Science were to be submitted via email to the above address, by **August 2, 2019**.
- Volunteers for the NASA Mars Strategic Architecture study group were to email Michael Meyer by **August 14, 2019**.
- Initial suggestions for edits to the MEPAG Goals, regarding content or prioritization, were to be submitted via email to a Goals Committee member or via [google form](#), by **August 16, 2019**.
- Current plans are to have the next virtual MEPAG meeting (VM6) in the fall and the next face-to-face MEPAG meeting in January or February 2020.

Past and On-going MEPAG Activities

- MEPAG Chair R. Aileen Yingst* [presented](#) the agenda for this meeting and an overview of recent MEPAG activities.
 - A key accomplishment since the last MEPAG Meeting was the completion of the ICE-SAG Report.
 - Key discussion foci for this meeting are future preparations for the next Planetary Decadal Survey and answering the Big Questions posed by NASA Headquarters (discussed more under **MEPAG Future Work**).
 - Aileen noted that MEPAG’s top priority, in looking towards the next decade, is completing Mars Sample Return.

**replaced Jeff Johnson at the last [virtual MEPAG meeting/VM5](#) (June 6, 2019).*

Past and On-going Mars Robotic Mission Activities

Three NASA officials presented on the state of NASA Planetary Science Division (PSD) and Mars Exploration Program (MEP) work: NASA PSD Director Lori Glaze, NASA MEP Director Jim Watzin, and NASA Lead Mars Scientist Michael Meyer.

- Lori Glaze [discussed](#) ongoing NASA PSD missions, NASA’s Moon to Mars strategy and Mars Sample Return campaign, the Discovery and New Frontiers programs, and the upcoming Planetary Decadal Survey. Some key points:
 - Within the current NASA Mars missions, key developments are that *Insight* will likely extract the housing of the Heat Probe, *MSL/Curiosity* is now drilling in the clay layer "unit", and *Mars 2020 rover* is on track for launch with all instruments delivered. NASA is also

- supporting the Japanese Phobos Sample Return mission (*Mars Moon Explorer/MMX*) with the Gamma ray and Neutron Spectrometer (MEGANE) being supplied by APL. Additionally, NASA is investing actively in “Moon to Mars,” with commercial suppliers coming into play.
- Beyond 2020, Mars Sample Return is underway with a NASA-ESA agreement on how to proceed and funding support in the NASA FY19 and FY20 budgets. Technical studies are underway by both NASA and ESA. Those within NASA involve many centers. See below for details.
 - SIMPLEx is underway with three \$55M cost-capped missions selected for Phase-A/B studies. Both Lori and Thomas Zurbuchen are excited about the opportunities provided by these low-cost missions.
 - Additional points raised by questions: SIMPLEx is currently a rideshare program with only NASA launches (i.e., not looking at rideshare opportunities with new entrants, military, etc.), partially as many of those launches are to LEO or GTO, and many planetary mission concepts would need a rideshare out further. The [Commercial Lunar Payload Services \(CLPS\) program](#) is going very well; as this experiment moves forward there may be potential for extending it beyond the Moon. For an overall plan to integrate more small satellites into planetary exploration, Lori is hoping the next Planetary Decadal Survey will recommend how to incorporate small satellites into the NASA exploration portfolio.
 - Updates to the Discovery and New Frontiers Programs included the recent selection of *Dragonfly* for New Frontiers-4. Discovery proposals were due July 1st, with selection for Phase-A studies later in 2019. The next New Frontiers call is planned to be issued in **late 2022**; as this is before the next Planetary Decadal Survey process is completed the targets will be from the current list (which has no Mars candidates). The cadence for both Discovery and New Frontiers proposals will be every 4-5 years (with an aim to select 2 Discovery missions per announcement) as that would decrease the frequency of pulling together all of the NASA infrastructure needed to support the competition process, as well as the pull on the community. Lori also noted that the expectation is that there will be one, maybe two, Flagship missions in the next Decadal Survey time frame.
 - With regards to the decision to decrease the frequency of running mission competitions, it was pointed out that on the proposer side, that may cause difficulties in keeping a proposal team together.
 - NASA and the National Science Council still need to set up the panel structure for the next Planetary Decadal Survey; it is not yet decided if this should be organized by planetary bodies as was done for [Visions & Voyages](#) (V&V) or by Science Question/Themes (prompting Lori’s request for key science questions, noted above). It is also not yet known how human exploration may be included in the upcoming Decadal Survey discussions.
 - Additional points raised by questions: If a start of Mars Sample Return (MSR) is included in the FY20 budget (which would be consistent with the [mid-term review of V&V](#) recommendation to continue to pursue MSR; e.g., see Fig. 9.1 of V&V), those missions would stretch into the period considered by the next Planetary Decadal Survey and would take some of that budget wedge; but even in this case, Lori expects there will be room for at least one other flagship mission. There is an expectation that community-generated white paper submissions will include both papers driven by big questions across targets and those focused on a specific target, as was seen in the last Planetary Decadal Survey process.
 - A question was raised about delays in closing out the recent Senior Review process for ongoing missions. Lori confirmed that they are working to complete that process, but the delay is due to complications in reconstituting the Advisory Councils, which requires actions beyond the purview/control of PSD and NASA.

- Jim Watzin and Michael Meyer [presented](#) on progress in developing the MSR strategy. This includes the build of the NASA *Mars 2020 rover* as well as discussions between NASA and ESA for future steps in MSR. They also briefly [discussed](#) pathways for Mars science “beyond MSR.”
 - There has been outstanding recent progress on Mars 2020: most instrument deliveries have been completed and Mars 2020 is now in ATLO. The Mars 2020 hardware goes to the Cape in December and the rover goes to the Cape in February, with the launch window opening in July. With much effort and some pain, there are now adequate reserves for this project to support final work. The Mars Helicopter, which is a technology demonstration, has a 30-sol lifetime that supports five flights, and has been mated with the rover.
 - There has substantial progress on reaching a NASA-ESA agreement on how to jointly conduct MSR with the Europeans. NASA approval to plan to proceed is now in place. To support this work, NASA is formulating a new campaign management structure. ESA has started studies which will be reviewed in September and then followed by a Ministerial meeting (for full approval) in November 2019. The signal for the U. S. commitment would be in the 2020 U.S. President’s Budget to be released in early 2020. Reasonable launch opportunities in 2026 and 2029 have been identified, which would enable samples to be returned to Earth in 2030.
 - One of the key elements of the Mars Exploration Strategy is understanding how the returned Mars samples will be studied. To support that work, responses to a call for Returned Sample Science Participating Scientists on M2020 are being reviewed; there will also be a more traditional call in the future for Mars 2020 Participating Scientists.
 - Additional points raised by questions: Currently there are no plans to use the Earth Return Orbiter (ERO) or other campaign components to support science beyond MSR as the directive is to keep it focused. Additionally, the ERO has intensive propulsion needs due to the planned timetable for returning the samples, and so can’t add more mass. Currently there is no consideration in the MSR architecture for using a SpaceX rocket. The response was that present planning is utilizing existing capabilities, but that advanced capabilities would be considered as they come online.
 - A question was raised about whether NASA had any potential plans for a new Mars science orbiter: there currently are no specific plans for a new orbiter (beyond the ERO, which would not stay at Mars nor collect science beyond that needed for MSR, see above). However, NASA is interested in what science could be accomplished “beyond MSR.”
 - It was pointed out that waiting until after MSR (i.e., after ~2030) to add a mission to complete or support new Mars science investigations is a long wait; Michael Meyer clarified that “beyond MSR” does not necessarily mean after MSR.
 - Following the recommendations made in the [mid-term review of V&V](#), a Mars Strategic Architecture study group is being set up by NASA, with Bruce Jakosky (CU Boulder/LASP) as Chair. The scope and membership of this study group is being worked. Volunteers for this study should email [Michael Meyer](#) about their interest (by **August 14, 2019**, with subject line “Mars Strategy”). A first report of progress on this strategic architecture is due in January/February 2020, with the intent that a final report would be available for deliberations by the next Planetary Decadal Survey.

Reports were then given about current and upcoming Mars missions from NASA and other agencies.

- Jorge Vago, ExoMars Project Scientist, [presented](#) a status report on the status of the ExoMars mission to deliver a rover and surface platform to the surface of Mars.
 - *ExoMars*, a joint European Space Agency and the Russian space agency (Roscosmos) mission, is a two-part astrobiology project to search for evidence of life on Mars. The first part, *TGO*, was launched in 2016, with an instrument payload provided by ESA and Russia and a telecommunications relay package provided by NASA. The second part of the program

is the *ExoMars 2020 Rover*, now named *Rosalind Franklin*, to which NASA contributed the Mars Organic Molecule Analyzer (MOMA) instrument. The *ExoMars* rover, like the Mars 2020 rover is completing its system integration, with a launch window opening on July 26, 2020 and arrival on Mars in early 2021.

- The current European Mars orbiters, *Mars Express* and *Trace Gas Orbiter (TGO)* are producing good scientific data. Additionally, TGO operates as a relay for Mars surface missions and currently returns 60% of the data from the *Curiosity* rover and *InSight* lander.
 - Additional points raised by questions: The ExoMars Rover is solar powered and can operate up to an atmospheric optical $\tau \sim 2$ and hibernate under higher τ . But it likely cannot survive a deep and long-lasting storm like the one in 2018.
- Ken Williford, Deputy Project Scientist for the NASA 2020 Mars rover, [reported](#) on the 2020 Mars rover. The Mars 2020 Science Team training is underway and the 2020 Mars rover landing site (i.e., Jezero Crater) and environs are being mapped at 1:5,000 scale.
 - Additional points raised by questions: Mapping of the landing ellipse is complete and focus is now on bringing the mapping of the intervening terrain between Midway and Jezero Crater sites to a similar level of detail. That mapping would help enable a future lander with fetch rover and MAV to land close to sample caches, even if the M2020 rover goes outside Jezero crater. Locating the tubes given the imagery that will have been completed (matching rover and orbiter data) is not expected to be a problem.
- Tomohiro Usui, Co-Investigator on JAXA's *Mars Moon Explorer (MMX)*, [presented](#) on *MMX* which will be the third Japanese sample return mission, this one targeting the Martian moons. *MMX* will launch in 2024 to land and collect samples from Phobos once or twice, along with conducting Deimos flyby observations and monitoring Mars' climate. Ten grams of samples will be returned to Earth in 2029. This mission addresses whether the Martian moons are captured asteroids or the result of a giant Martian impact.
- Sarah Al Amiri, Science Team Lead on UAE's *Emirates Mars Mission/EMM (Hope)*, [presented](#) on *EMM*. This mission will also launch in July 2020 and arrive at Mars in February 2021. Its aim is to examine the Martian atmosphere from a global-perspective, by viewing from a large elongated orbit whose periapsis would be near the orbit of Deimos. The spacecraft is fully integrated for tests, with all but one of the flight instruments delivered (the engineering model is being used for the tests). The integrated spacecraft and payload are currently undergoing system checkouts. Once the mission is underway, they plan to release data every two months.
 - Additional points raised by questions: While not part of the primary mission science, the *EMM* orbit would allow for observations of Deimos within an extended science mission.
 - Dr. Amiri noted that the MEPAG Goals Document was a very useful resource when the *EMM* science team put together the mission science goals.

On-going and Planned Human Mars Exploration Activities

- Paul Niles (JSC) [reported](#) for Jake Bleacher, Acting Chief Scientist within HEOMD. He described the Artemis Program, in which Phase 1 will address the first human lunar mission and Phase 2 will address subsequent missions including preparing for going on to Mars. Artemis work will include development of Human Landing Systems, which will be a mostly U.S. work with potential international opportunities.
 - Having the Lunar Gateway in place is essential for a human lunar landing in 2024. Astronaut training for these missions is already underway.
 - [Commercial Lunar Payload Services \(CLPS\)](#) is a NASA program to contract transportation services able to send small robotic landers and rovers to the Moon's south polar region mostly

with the goals of exploration, *in situ* resource utilization (ISRU), and lunar science to support the Artemis Program. The CLPS program is being operated jointly by NASA Headquarters' Science Mission Directorate (SMD), in conjunction with the Human Exploration and Operations (HEOMD) and Science Technology Mission (STMD) Directorates. Flight opportunities are scheduled to start in mid 2020. This is a pioneering effort to enable commercial companies to provide transportation and services traditionally designed by NASA.

- Rick Davis, NASA HQ SMD, [reported](#) on studies to identify resources on the Moon and Mars. In particular, studies are underway to generate maps of subsurface ice (0-10 m depth) and specific surface minerals from orbital data already in hand. Such work will inform both landing site studies and development of the resource verification and civil engineering needed to support humans.

MEPAG Future Work

- A brief report on the [Ninth International Conference on Mars](#) was presented by Rich Zurek, who pointed to the Integration Reports, that will be posted on the conference and MEPAG websites.
- MEPAG Goals Chair Don Banfield [presented](#) on the upcoming revision work to the [MEPAG Goals document](#).
 - Rebecca Williams (PSI) is the new Goal III Representative, filling the role vacated by Aileen Yingst (as she became MEPAG Chair). Becky Williams joins Briony Horgan, who joined as a Goal III Representative a few months ago. The full Goals Committee membership can be viewed [here](#).
 - The upcoming update by the Goals Committee will use as an input the presentations and Integration Report from the [Ninth International Conference on Mars](#). The Goals Committee plans to release a revised draft of the MEPAG Goals document for community comment late this year. After a second round of work, the aim is to release the official revised Goals Document by ~March 2020, so that it is ready for the upcoming Planetary Decadal Survey Committee.
 - Additional suggestions from the community with regard to edits to content or priority within any of the Goals, as well as about the Cross-cutting Theme section, were due by **August 16, 2019** and were to be submitted via the google form or email to a Goals Committee member. Don emphasized that throughout the revision process, in addition to formal mechanisms, he and other members are open to dialogue.
 - A question was raised about how the Goals Committee will consider and weigh inputs from the community. Don emphasized that Goals Reps were chosen based on their breadth and integration abilities – so we expect them to take in and process inputs, identifying where the key/repeated points are. Changes will be reviewed by the MEPAG Executive Committee and possibly selected outside reviewers, and the draft 2020 MEPAG Goals Document will be presented to the community for comment, via email or at MEPAG meetings, before the document is finalized.
 - Comments were made about how to discuss science questions that integrate across the four MEPAG Goals, and in particular how to consider cross-discipline work within Goal IV/Preparation for Human Exploration. The 2015 MEPAG Goals Document added more recognition of cross-cutting science questions, and ideas for how to further improve those sections are welcomed. Goal IV is kept separate as it has more of an engineering focus, although identifying needed science measurements. Additionally, the immediate focus of this revision is to get the document ready for the next Planetary Decadal Survey process, and it's not yet known how human exploration will be factored into that process. However, in considering potential revisions to Goal IV at this time, all existing and available studies related to human exploration (e.g., precursors, strategic knowledge gaps, architectures) can be considered as inputs.

- A question was raised about how the new MEP-chartered Strategic Architecture study (see Michael Meyer's presentation) should consider the MEPAG Goals Document, given their work and the Goals revisions will be completed in parallel. Although this will be a consideration as the study gets underway, the current/2018 Goals Document is reasonably up-to-date and is a reasonable input for the Strategic Architecture study. The two activities will also exchange notes on progress of their separate tasks.
- Serina Diniega (MPO/JPL) [presented](#) some initial plans for how MEPAG can facilitate Mars community preparation for the upcoming Planetary Decadal Survey process, especially with regards to generation of white papers.
 - Other AGs may follow similar efforts, and the MEPAG Executive Committee will be checking with the other AGs.
 - It was emphasized that any facilitation tools by MEPAG are meant to be helpful tools, not a gate. Participation with any facilitation efforts by MEPAG is open for use as much as people find it to be helpful.
 - Additionally, anyone can submit White Papers. There was discussion that that White Papers with multiple authors *may* have bigger impacts. White Papers that look broader than Mars and that include authors from outside the Mars communities also should be considered.
- Aileen Yingst then gathered feedback on (1) a request from Lori Glaze on the Big Questions and (2) Draft Findings from this meeting.
 - ***Final compilations of both of those documents will be posted to the [MEPAG 37 meeting page](#).***
 - Additional points raised by questions:
 - MEPAG can potentially help with the next steps in MSR by running studies/gathering information requested by NASA regarding science activities in preparation for MSR – such as sample handling and sterilization.
 - While there was good space agency/country diversity at both the Ninth International Conference on Mars and MEPAG 37, there was a lack of information about Chinese efforts at these meetings, partially as there was a conflict in schedule during the conference week with a meeting in China. Jim Head (Brown University) was at that meeting and has agreed to provide a report on the Chinese Mars developments at the next MEPAG virtual meeting.
 - We again emphasize that all Mars community members are welcomed to attend MEPAG meetings.