

**Summary of the Presentations and Discussion of the
MEPAG Virtual Meeting #5 (VM5)
June 6, 2019; virtual attendance only, 11:00AM-1:00 PM EDT**

*Posted agenda and presentation files: <https://mepag.jpl.nasa.gov/meetings.cfm?expand=VM5>
Notes present an overview of discussion as well as brief summary of presentation materials.
Links are provided to full presentation materials.*

Topics for today's virtual meeting (VM #5) were:

- 1) MEPAG Updates since VM #4 (February, 2019)
- 2) NASA Headquarters update
- 3) Ice and Climate Evolution Science Analysis Group (ICE-SAG) Final Report
- 4) 9th Mars Conference
- 5) MEPAG 37th Face-to-Face Meeting
- 6) Meeting Reports, Notices
 - a) Humans to Mars Summit: ISRU panel
 - b) Mars Sample Return Science Planning Group (MSPG) update
- 7) MEPAG Chair Transition: Welcome Dr. R. Aileen Yingst
- 8) Discussion/Meeting Close

Meeting attendance included approximately 110 distinct logins.

General MEPAG Announcements

- Welcome to our new MEPAG Chair, Dr. R. Aileen Yingst (PSI) and thank you to our past Chair, Dr. Jeffrey R. Johnson.
- Please respond to all requests for general or meeting-specific MEPAG feedback via the email MEPAGmeetingQs@jpl.nasa.gov.
- The next MEPAG meeting (#37) will be held at Caltech, Pasadena, CA on July 26, following the Ninth International Conference on Mars. In-person and remote attendance are possible – advance registration for in-person attendees is due June 28, via link in 1st Informational Circular: <https://mepag.jpl.nasa.gov/meeting/2019-07/37th%20MEPAG%201st%20Circular.pdf>.

1) MEPAG Update, by Jeff Johnson (APL)

Slides: https://mepag.jpl.nasa.gov/meeting/2019-06/01_Johnson_Opening_MEPAG_VM5_v04.pdf

MEPAG Chair Jeff Johnson presented an overview of MEPAG activities.

- Since the February 25, 2019 MEPAG Virtual Meeting #4 ...
 - Aileen Yingst has agreed to be the next MEPAG Chair! (more below)
 - MEPAG Goals Committee Changes
 - Michelle Rucker, NASA Johnson Space Center (JSC), has been added as a MEPAG Goal IV (Preparation for Human Exploration) Representative, replacing Ryan Whitley (NASA JSC). (Current Executive and Goals Committee membership can be viewed at <https://mepag.jpl.nasa.gov/about.cfm>.)

- The MEPAG Executive Committee is considering candidates to replace Aileen Yingst, a Goal III (Geology) Representative (as she is now the MEPAG Chair).
- Supporting preparations for the next decadal survey
 - Explored the use of google docs to facilitate communication on white papers. This was discussed at an LPSC "MEPAG greet and meet" session; those present thought the use of google docs would be valuable.
 - Created google docs spreadsheet in support of the community's response to the recent call for Planetary Mission Concept Studies (see below).
 - Working with other AGs on joint statement on diversity goals.
- Upcoming Mars and MEPAG Activities were identified, including:
 - Planetary Science Advisory Committee (PAC) presentation the following week [UPDATE: *this meeting has been postponed due to delays in the annual re-certification of the PAC advisory status*].
 - [9th International Conference on Mars](#) July 22-25, 2019 @Pasadena, CA
 - Face-to-face [MEPAG Meeting #37](#), July 26, 2019 (following 9th Mars)
 - [Mars Extant Life: What's Next?](#), November 5-8, 2019 (rescheduled from Jan 29-Feb 1, 2019 due to the US federal government shutdown) @Carlsbad, NM

2) NASA HQ Update, by Michael Meyer (NASA HQ)

No slides shown

Michael Meyer, the lead scientist for NASA's Mars Exploration Program at NASA Headquarters, presented on the current state of NASA's Mars Exploration Program (MEP) work.

- The review panels for six continuing PSD missions (Mars Odyssey, NASA's contributions to Mars Express, the Lunar and Mars Reconnaissance Orbiters, Mars Science Laboratory (Curiosity) and the Mars Atmosphere and Volatiles Evolution (MAVEN) orbiter) completed their work in May as part of the 2019 Planetary Mission Senior Review. The six panel reports have been integrated by a Senior Review Subcommittee. Based on all the reports, the NASA Planetary Advisory Committee (PAC) will make their recommendations to the Planetary Science Division (PSD). PSD will provide specific direction, including planning budgets, to the projects for the 3-year cycle FY20-22 by July 8.
- For recent NASA competitions:
 - Support for the selected Mars Data Analysis Program recipients will be distributed soon.
 - Proposals for Mars 2020 Sample Scientist Participating Scientists have been reviewed. Final selections will be announced this summer with an aim to have them on contract in FY20.
 - Proposals for the [ROSES NRA C.30 \(Planetary Mission Concept Studies\)](#) were due May 31, and ~a quarter of these proposals related to Mars.
- The second COSPAR Sample Safety Assessment Protocol (SSAP) group met in May. This group addressed what rules need to be followed to keep Earth safe from the samples and what should be considered at the next meeting; e.g., how to sterilize samples before they are distributed, and how to handle heterogeneity within a sample when making that assessment.

- NASA's response to the Mid-Term Decadal Study included three areas relevant to Mars: Mars Sample Return (MSR), telecom infrastructure for future missions, and the need for a strategic plan as input to the next Planetary Science Decadal Survey.
 - MSR: The last Planetary Science Decadal Survey ranked the first step in Mars Sample Return as the highest priority for flagship missions for the current decade and understood the implied commitment for the next decade, assuming adequate progress on the campaign and noting the likely need for international partnering. Current NASA activities are generating acquisition and implementation plans with the European Space Agency (ESA) in order to get agreement on the next steps in the MSR campaign by the end of 2019. Funding to proceed to the next steps for the follow-on MSR flight missions was included in the President's FY20 budget request.
 - NASA also agrees on the importance of a telecommunications infrastructure for future Mars missions, including the next steps in MSR. While Odyssey and MRO continue to provide relay to surface assets, MAVEN recently completed an aerobraking campaign, putting it into a more favorable orbit for relay. In parallel, ESA's Trace Gas Orbiter has become a valuable relay asset and currently returns more than half of the data returned from Curiosity on a daily basis.
 - NASA is considering how to update to the NASA Strategic Plan that needs to be in place in 2020. The work to produce such a plan would be chartered by NASA Headquarters with help expected from MEPAG and the Mars community. This will be an important input to the next Planetary Science Decadal survey. Identification of key science objectives for the future can start with the MEPAG Goals document, which will be updated based on presentations and reports made at the upcoming 9th International Mars Conference.
- The Mars 2020 overruns within FY19 are a challenge and are currently being addressed within the Mars Exploration Program and Planetary Science Division. Work on the mission continues to progress and much of the remaining cost-risk should be retired as the instruments and subsystems are delivered for assembly and test this summer. NASA remains dedicated to launching in 2020.
- A question asked whether there was any consideration of returning the drilled samples by the upcoming ESA ExoMars rover Rosalind Franklin. The ExoMars rover does not cache samples, so a follow-on mission to prepare a sample cache would be needed. The focus of current return studies is how to return samples prepared and cached by M2020. M2020 and Rosalind Franklin will both be operating on Mars at the same time but in widely separated locations (Jezero Crater and Oxia Planum, respectively). For the process of selecting M2020 cached samples, it was noted that the M2020 Science Team will determine what samples are collected and which are cached, and will recommend which samples should be returned to Earth. (More samples will be cached by M2020 than are planned to be initially returned.) The recent selection of sample scientists will augment the M2020 Science Team for this purpose.
- A question was asked about the impact of [Artemis](#) on the NASA budget. It was noted that the NASA Headquarters plan to form a new Moon and Mars Exploration Directorate never came into being. Discussions continue about how to move forward on the "to the Moon and Mars" campaign.

3) ICE-SAG Report, by Than Putzig (PSI) and Serina Diniega (JPL)

Slides: https://mepag.jpl.nasa.gov/meeting/2019-06/03_ICE-SAG%20Report%20MEPAG%20VM5_URS.pdf

ICE-SAG Co-chairs Serina Diniega (JPL) and Than Putzig (PSI) presented the final report from the MEPAG-chartered Ice and Climate Evolution Science Analysis Group (ICE-SAG).

- The ICE-SAG was tasked with identifying:
 - High-priority science objectives pertaining to Polar Science, Modern Mars and Recent Climate (separate from Mars Sample Return) for the 2023-2032 decade and mapping them to [MEPAG Goals](#).
 - Measurements required to address the science objectives.
 - Mission approaches to address the science objectives and required measurements including orbiters, landers, rovers, drillers and networks via small spacecraft, Discovery, New Frontiers and Flagship-classes.
- Updates to the report since the previous presentation, at MEPAG Meeting VM4, have occurred based on comments from 17 reviewers. These included:
 - Clarification of the compelling reasons to study Mars' ice reservoirs and climate history.
 - Clarification of the aim and scope of ICE-SAG, which relates to the areas of current knowledge and types of missions described within the report.
 - Clearer prioritization of the science questions outlined in the report, and improved tracing from these questions to the mission concepts.
- A Pre-print version of the report was accepted by the MEPAG Executive Committee and publicly [released](#) on May 28, so as to make its contents available to the community before the end of May. This Pre-print includes:
 - A listing of high-priority science questions within 5 Priority Science Areas,
 - A listing of high-priority measurements needed to address these questions,
 - Five New Frontiers cost-class mission concepts that, between them, address the highest-priority science questions,
 - Description of smaller and larger cost-class mission concepts that also address these questions, including 3 small spacecraft concepts, and
 - Supplementary Materials that include the results from the mission concept engineering studies (including very rough cost estimates) completed in support of ICE-SAG discussions.
- A final version of the ICE-SAG report, with final linkage and reference cleanup and Appendix C added, is planned to be posted by the end of June.
- A question was asked about whether a specific implementation (polarimetry to study clouds) was discussed within ICE-SAG, as it did not appear within the report. This specific implementation had not been discussed, and ICE-SAG acknowledges that there are likely many techniques that this group did not explicitly consider when generating our mission concepts. The purpose of the measurement traceability was not to cover all possibilities but to demonstrate via "proof of concept" that significant progress could be made. In the ICE-SAG report, prioritization is focused on the science questions.

4) Ninth International Conference on Mars, by Serina Diniega (JPL/MPO)

Slides: https://mepag.jpl.nasa.gov/meeting/2019-06/04_9thMars_VM5_v2.pdf

Conference Co-convenor, Serina Diniega, presented on the status of planning for The Ninth International Conference on Mars, which will be held on Monday-Thursday, July 22-25 at Caltech campus, Pasadena, CA: <https://www.hou.usra.edu/meetings/ninthmars2019/>.

- This conference aims to bring together all “martians” – a strength is our synthesis of information, pulling people out of their individual areas of interest and focusing on key science questions, establishing at a high-level “*what do we know now*” → “*what do we still need to know*”.
 - The [8th Mars](#) conference was held in 2014, with nearly 400 abstracts (limited to one per presenter) and over 650 attendees from about 20 countries. For 9th Mars, 442 abstracts (again limited to one per presenter) were received.
- The program was posted on the 9th International Conference website <https://www.hou.usra.edu/meetings/ninthmars2019/> on June 7th. Many thanks to the Science Organizing Committee members who pulled together the program in <2 weeks.
 - Also posted with the 3rd Announcement are Policies and Guidelines for Attendees and Presenters.
- Some deadline reminders:
 - Note hotel blocks will close June 21st; information is on the [Logistics page](#).
 - Advance [Registration](#) is due July 11 for 9th Mars.
 - If you need to forecast for conferences and meetings, please do so soon and note that this is separate from MEPAG 37: NCTS# 31488-19 for this conference.

5) MEPAG 37th Face-to-Face Meeting Agenda, by Rich Zurek (JPL/MPO)

No slides – a draft agenda was shown and is representative, but will be superseded by an update to be posted in a few weeks.

As noted above, MEPAG’s 37th Face-to-Face meeting will be held on Friday, July 26th at Caltech, Pasadena, CA -- following the Ninth International Conference on Mars. The First Information Circular was posted May 30 and can be found at [the meeting website](#).

- The meeting is planned to run 8:30AM - 1:00 PM PDT, so as to allow in-person participants to catch late afternoon and evening flights.
- Topical areas for the agenda, which is still being worked, will include:
 - NASA Planetary Science Division and Mars Exploration Program status,
 - Mars Missions in Development,
 - HEOMD and Commercial Space, and
 - Looking forward to the next Planetary Science Decadal Survey.
- Some deadline reminders:
 - The hotel block is the same as that for the 9th International Conference on Mars, with the same deadlines (i.e., June 14 and 21) – see above.
 - Advance [Registration](#) is due June 28.
 - If you need to forecast for conferences and meetings, please do so soon and note that this is separate from 9th Mars: NCTS# 38468-19 for MEPAG 37.

6.a) Human to Mars Summit (H2M): ISRU Panel Report, by Scott Hubbard (Stanford U)

No slides presented.

Scott Hubbard attended this meeting, where he chaired two sessions: One on whether there is a commercial market at the Moon and one on the state of In-Situ Resource Utilization (ISRU) for the Moon and Mars. He gave this overall report:

- Humans to Mars Summit is an annual gathering of industry, NASA, other government and some academic people interested in humans to Mars. The attendees include managers, engineers, technologists and educators from a variety of institutions. A sprinkling of scientists usually attends as well.
 - Although attendance in person has typically been in the few hundreds, virtual participation has been much greater. The latest meeting May 14-17 had about 45,000 unique views on line.
 - The NASA Administrator usually attends and gives an overview of the latest human space flight planning. This year Bridenstine emphasized elements of Artemis and the return to the Moon, although he did refer quite often to the search for life on Mars. While short on specifics, the Administrator did always include the journey to Mars as the horizon goal.
- The Commercial Moon Panel included NASA, the FAA and two advocates/practitioners. From Scott's perspective, NASA's Commercial Lunar payloads (CLPS) program satisfies some of the requirements to meet the Space Policy test of "commercial" but not all. CLPS is thus an experiment in progress.
- The ISRU Panel addressed the following questions:
 - Where are the resources? How sure are we? What else needs to be done to validate and verify the amount and accessibility of the resource?
 - How do we mine/transport the resources?
 - How do we convert them to usable compounds and materials?
- With the help of H2M, Scott populated the Panel with 5 experts, ranging from pure science (David Lawrence/APL) to Applied science/resource Maps (Sydney Do, JPL) to technologists expert in mining/conversion (Jerry Sanders, JSC ; Barry Finger, Paragon Co.) to a "big picture" human exploration architect (Rick Davis, NASA HQs)
 - After a 75-minute panel discussion, the following insights emerged:
 - A more precise knowledge of resources at Mars and the Moon is required. To verify claims of ~30% water weight on the Moon a Lunar lander is required. Similarly, the exact spatial extent of water ice on Mars should be improved via 0-10 m SAR.
 - While the conversion of resources is relatively simple physics, the engineering appears to be quite complex. Also, as a result of the LCROSS mission, it seems water ice contamination is quite high. What would such a system cost?
 - Finally, planners must always trade significantly lower launch costs with the price and complexity of ISRU. Mars is more like operating in the high Himalayas than the Sahara desert and risk assessments should reflect that.
- Next steps on ISRU will be an "Achieving Mars VII" (AMVII) workshop at George Washington University in Washington DC with ISRU experts in August (dates TBD).
- In the Q&A, the question was asked as to whether microbial biotechnology was being considered for ISRU. The response was that it was not mentioned at the prior meeting but should be suggested as a topic at the upcoming meeting.

6.b) MSR Science Planning Group (MSPG) Update, by David Beaty (JPL/MPO)

Slides: https://mepag.jpl.nasa.gov/meeting/2019-06/07_MSPG%20for%20MEPAG%20VM5%20v2.pdf

Dave Beaty described work by the international MSPG, which was established by NASA and ESA in 2018 in order to develop a stable foundation for international scientific cooperation for returning and analyzing samples from Mars.

- MSPG has held two workshops thus far.
 - Workshop #1 focused on: What measurements must be performed in contained space, including characterization of samples before release outside of the Sample Receiving Facility (SRF)? A major finding was that a large majority (75-90%, depending on sterilization parameters) of the MSR-related science investigations could be acceptably performed on sterilized samples, thus potentially enabling the analysis of MSR samples in uncontained laboratories without a dependency on the results from Planetary Protection testing. Another major finding was that the scientific community, for reasons of scientific quality, cost, timeliness, and other reasons, strongly prefers that as many sample-related investigations as possible be performed in PI-led laboratories outside of containment.
 - For Workshop #2, the key question was “What are our strategies to achieve MSR science objectives, given SRF-related contamination?” The major finding from this workshop was that even though the Mars 2020 Sample Contamination Control (CC) Requirements were very restrictive, the workshop participants were collectively not aware of reasons why these requirements could not be met in isolation cabinets on Earth. The Mars 2020 rover contamination requirements for sample-intimate hardware then are a reasonable starting point for contamination control planning for the SRF and/or sample curation facilities, although SRF sample-intimate hardware cleanliness requirements might need to be more strict in some specific areas.
 - Other strategies for meeting the MSR science objectives, along with implementing stringent CC requirements include:
 - Characterizing contamination at all phases of MSR campaign and in SRF using multiple/optimized contamination knowledge strategies,
 - Planning procedures to minimize sample handling, and
 - Characterizing and curating all tools and materials used in construction of the SRF and that would be in contact with the samples.
- It is anticipated that there will be multiple competed access opportunities for scientists, starting with Initial Activities and continuing through Investigations within SRF containment and Investigations outside/beyond SRF containment. Initial Activities via membership on Preliminary Examination Team (or equivalent) could include activities such as microbeam imaging, curation, inventorying, and initial sample descriptions. Investigations within SRF containment would conduct time-critical measurements as well as those measurements that would be disturbed by sterilization. Investigations outside/beyond SRF containment would be done with samples released/transferred from SRF (if not sterilized, their release would be contingent on sample safety assessment).
- During Q&A, it was noted that there has been no NASA response to the National Academy Planetary Protection Report. ***The MEPAG Executive Committee will follow up by looking into this.***

- It was also noted that integrating SSAP (above) and MSPG activities would be a good thing to pursue at a future meeting.

7-8) MEPAG Chair Transition and Wrap-up, by Jeff Johnson (APL) and Aileen Yingst (PSI)

- *No slides shown.*
- Jeff Johnson formally welcomed Aileen Yingst (PSI) as the new MEPAG Chair.
 - Dr. Yingst is a planetary geologist whose research focuses on the texture and morphology of rock outcrops and clasts. She is currently the Deputy Principal Investigator for the Mars Hand Lens Imager instrument (MAHLI), a science team member for the Mars Science Laboratory (MSL) imaging science team, and a Co-Investigator on the SHERLOC/WATSON instrument on the Mars 2020 rover.
- Jeff Johnson has served as MEPAG Chair for the last three years, and will remain on the MEPAG Executive Committee as “Past Chair.”
 - Jeff thanked all who have been involved with MEPAG activities during his three years as MEPAG Chair and noted that the Mars program has significant momentum even as it faces significant challenges ahead.
 - Many people, verbally and via the chat-window, thanked Jeff for his service.
- Aileen noted that she is honored to have been named as MEPAG Chair, particularly looking back on the accomplishments of the past MEPAG Chairs.
- Aileen and Jeff noted that they look forward to seeing everyone at [MEPAG 37](#) at Caltech on Friday, July 26th.