

Mars Exploration Program Analysis Group (MEPAG)

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



Welcome to the 32nd MEPAG Meeting

October 6, 2016

Jeffrey R. Johnson, MEPAG Chair



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Artist's concept of an astronaut to scale with Murray buttes, Curiosity right Mastcam, sol 1436

NASA / JPL / MSSS / Seán Doran

<http://www.planetary.org/blogs/emily-lakdawalla/2016/08231454-how-big-is-that-butte.html>

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MEPAG virtual meeting: October 6, 2016

Electronic meeting (Adobe Connect): 8:30am-12:30pm PDT

Times shown are PDT, all presenters should include time for discussion

<u>Start</u>	<u>Duration</u>	<u>Title/topic</u>	<u>Presenter</u>
8:30	0:30	Past and ongoing MEPAG activities	J. Johnson, MEPAG Chair
9:00	0:45	MEP status and plans	J. Watzin
9:45	0:45	Mars science and Mars science activities	M. Meyer
10:30	0:10	InSight report	B. Banerdt
10:40	0:15	Questions	
10:55	0:15	Report on Biosignature Preservation & Detection in Mars Analog Environments Conf.	L. Hays, D. Beaty
11:10	0:10	Report on 6th Internat. Conf. on Mars Polar Science & Exploration	I. Smith
11:20	0:15	Report on survey of Participating Scientist programs	L. Prockter
11:35	0:15	Humans to Mars update	B. Bussey
11:50	0:30	Upcoming MEPAG activities	J. Johnson, R. Zurek, D. Beaty
12:20	0:10	Wrap-up	J. Johnson
12:30	--	Adjourn	

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Meeting Ground Rules for Virtual Meeting

- Speakers will be kept on time according to the agenda
- Questions can be entered into the chat box on Adobe Connect
 - Moderators will read question to speaker, who will answer them on the phone line
 - Feedback during and after meeting?
 - Email MEPAGmeetingqs@jpl.nasa.gov
- Problems with Adobe Connect or phone line?
- Ask in the chat box, or email MEPAGmeetingqs@jpl.nasa.gov
- Presentations and Meeting summary notes (once cleared and waived) will be made available on MEPAG website after October 7
 - Will include any “findings” resulting from today’s discussions

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Outline of Introductory Remarks

- Update on MEPAG activities and programmatics
 - Goals Committee updates
 - MEPAG website and newsletter
- National Academies review of Research and Analysis Programs
- Mars Water In-Situ Resource Utilization Planning Study (M-WIP) released
 - Joint SMD/HEOMD study, not a MEPAG-sponsored study, but relevant to MEPAG
- Planetary Science Subcommittee updates
 - From March and June meetings

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MEPAG Programmatics

- **New MEPAG Chair appointed in March:**

- Jeff Johnson (JHU/APL)
 - Also joined Planetary Science Subcommittee (9/14/16)
 - Lisa Pratt transitions to MEPAG Executive Committee



Hinners Point, Marathon Valley
<http://photojournal.jpl.nasa.gov/catalog/PIA19820>

- **Vacancies filled:**

- Goals Committee
 - Goal I <Life> (Sarah Stewart Johnson, Georgetown University)
 - Goal II <Climate> (Robin Wordsworth, Harvard University)
 - Goal IV <Human Exploration> (Jacob Bleacher, Goddard Space Flight Center)
 - Successor to V. Hamilton as Goals Chair to be selected by Executive Committee
- Executive Committee
 - Welcomed Scott Hubbard (Stanford University) as successor to the late Noel Hinners
 - Welcomed Ben Bussey (HEOMD, NASA HQ) as Ex Officio member

- **Mars Water In-Situ Resource Utilization Planning Study (M-WIP) released:**

- Studied hypothetical water reserves and engineering/geological requirements to create viable production system, and implications for exploration
 - Brief summary in subsequent slide; under consideration for larger presentation at the next MEPAG meeting

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MEPAG Programmatics

- **MEPAG website updates:**

- Terms of Reference updated (from 2011)
 - <http://mepag.nasa.gov/about.cfm>
- “Top” discoveries list soon to be updated (from 2012)
 - <http://mepag.nasa.gov/topdiscoveries.cfm>
- Meeting #31 Summary posted (March, 2016)
 - http://mepag.nasa.gov/meeting/2016-03/MEPAG31_Summary_v2.pdf
- Survey of MEPAG newsletter effectiveness conducted
 - <http://mepag.nasa.gov/announcements.cfm>
 - ~15 responses: Interest in more about non-US space agency plans/missions, and pointers towards “Mars in the news” items
 - Mars Project Office staff examining methods to obtain this information systematically

Top Discoveries of the Mars
Exploration Program
(as of 2012)

1. Ancient, Persistent Liquid Water
2. Complex Surface Geology
3. Modern Water
4. Recent Climate Change
5. Planetary Magnetism
6. Martian Climate and Weather
7. Modern Processes
8. Methane on Mars
9. Gravity and Figure
10. Mars Radiation Environment



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• Other recent/ongoing MEPAG Activities

- Assisted with National Academies Space Studies Board review of the Planetary Science Division's Restructured Research and Analysis Programs
 - See next slides summarizing presentation given May 13, 2016
- Our Red Planet (citizen science workshop) (A. Kaminski)
 - See M. Meyer's presentation at 9:45 AM
- Biosignature Preservation & Detection in Mars Analog Environments Conf.
 - See L. Hays/D. Beaty presentation at 10:50 AM
- 6th International Mars Polar Science Conference
 - See I. Smith's presentation at 11:10 AM
 - Goals Committee will discuss ~5 key questions arising from meeting
- Assisting with Participating Scientist white paper survey (L. Prockter)
 - See L. Prockter's presentation at 11:20 AM
- International Space Exploration Coordination Group white paper (B. Bussey)
 - See B. Bussey's presentation at 11:35 AM



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Request from NAS: MEPAG's (and other AG's) input for review of the Planetary Science Division's Restructured Research and Analysis Programs

What are MEPAG's views on PSD's current R&A programs and, in particular, what are MEPAG's views relating to questions 1 and 2 in the committee's statement of task?

- 1. Are the PSD R&A Program Elements appropriately linked to, and do they encompass the range and scope of activities needed to support the NASA Strategic Objective for Planetary Science and the Planetary Science Division Science Goals, as articulated in the 2014 NASA Science Plan?**
- 2. Are the PSD R&A Program Elements appropriately structured to develop the broad base of knowledge and broad range of activities needed both to enable new spaceflight missions and to interpret and maximize the scientific return from existing missions?**

Community Poll: 14 responses received between April 26 and May 9, 2016

<portion of presentation given May 13, 2016>

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Appendix B: NASA Strategic Goals and Objectives, SMD Division Science Goals, Decadal Survey Priorities, and SMD Missions

NASA Strategic Objective	SMD Division Science Goals	Decadal Survey Priority (Associated SMD Division Science Goals in parentheses)	SMD Missions (Associated Decadal Survey Priorities in parentheses)
NASA Strategic Goal: Expand the frontiers of knowledge, capability, and opportunity in space.			
<p>PLANETARY SCIENCE</p> <p>Ascertain the content, origin, and evolution of the solar system and the potential for life elsewhere.</p>	<ol style="list-style-type: none"> 1. Explore and observe the objects in the solar system to understand how they formed and evolve. 2. Advance the understanding of how the chemical and physical processes in our solar system operate, interact and evolve. 3. Explore and find locations where life could have existed or could exist today. 4. Improve our understanding of the origin and evolution of life on Earth to guide our search for life elsewhere. 5. Identify and characterize objects in the solar system that pose threats to Earth, or offer resources for human exploration. 	<ol style="list-style-type: none"> a. Building New Worlds—advance the understanding of solar system beginnings (1, 2) b. Planetary Habitats—search for the requirements for life (3, 4) c. Workings of Solar Systems—reveal planetary processes through time (1, 2, 5) 	<p>MESSENGER (a, c) BepiColumbo (a, c) Venus Express (a, b, c) Venus Climate Orbiter (a, b, c) LADEE (a, c) LRO (a, c) Hayabusa 2 (a, c) Rosetta (a, c) OSIRIS-REx (a, c) Odyssey (a, b, c) MRO (a, b, c) MAVEN (c)</p> <p>Opportunity (a, b, c) Curiosity (a, b, c) Mars Rover 2020 (a, b, c) ExoMars 2016 (c) ExoMars 2018 (a, b, c) Mars Express (c) Dawn (a, c) Juno (a, c) JUICE (a, b, c) Cassini (a, b, c) New Horizons (a, c)</p>

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Conclusions relevant to Committee's task

- Program Elements (PE) are (or can be) linked to PSD Science Goals, but
 - Large scope of Goals make this connection easily justifiable (which has pros and cons)
 - Explicit ties to PE are lacking in most NRAs (simple edits would address this)
 - Great concerns about effects of lumping so much research together under SSW
- PE encompass the range and scope of activities needed to support Science Goals, but
 - Some concerns about insufficient funding for specific fields of research
- PE mainly well structured to develop the broad base of knowledge/activities to *enable* new spaceflight missions, but
 - Lab studies, modeling, sample handling, landing site analyses (crucial to framing questions for future missions) are thought to lack dedicated emphases in specific PE
- General positive response to whether PE appropriately structured to develop broad knowledge base/activities to interpret/maximize the scientific return from existing missions, but
 - Concern regarding whether some key activities (modeling) have a “home” in any PE
 - Concern if development of knowledge base sufficient in PE to accomplish this

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Mars Water In-Situ Resource Utilization Planning Study (M-WIP) released:

- http://mepag.nasa.gov/reports/Mars_Water_ISRU_Study.pdf
- **Objectives:**
 - 1) Formulate descriptions of hypothetical reserves of water on Mars
 - 2) Estimate roughly the engineered system needed to produce each reference case
 - 3) Prepare a first draft analysis of the sensitivity of the production system to known/potential geological variations
 - 4) Prepare an initial description of the preliminary implications for exploration
- **Reference cases:**
 - Case A – glacial ice
 - Case B – a natural concentration of poly-hydrated sulfate minerals
 - Case C – a natural concentration of phyllosilicate minerals
 - Case D – regolith with average composition as observed from in situ missions
- **Follow-up work needed in multiple areas:**
 - technology development for ice and granular mining cases
 - advance mission planning (including in both the human and the robotic arenas)
 - improving our understanding of Mars, the geology, nature and mechanical properties of representative deposits
 - refining our exploration strategy from orbit and on the surface
- Follow-up study or workshop likely (TBD)

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Planetary Science Subcommittee meeting: March 9-10, 2016, findings related to Mars

https://smd-prod.s3.amazonaws.com/science-green/s3fs-public/atoms/files/PSS_March2016_findings_summary-Final.pdf
https://smd-prod.s3.amazonaws.com/science-green/s3fs-public/atoms/files/4_Green-PSD_tagged.pdf

Mars Sample Return: What happens to the landed canister, and how will the sample tubes be opened?

- “...In light of recommendations from the International Mars Architecture for the Return of Samples (iMARS) and International Mars Exploration Working Group (IMEWG), the PSS recommends a comprehensive and dedicated study of these design concepts in the context of both sample retrieval and a returned sample facility to handle and manage scientific study of samples.”

Response from NASA HQ at June 7 meeting:

“Concur. This type of analysis has been done previously and will be updated at a later date.”

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Planetary Science Subcommittee meeting: March 9-10, 2016, findings related to Mars

Special Regions: How do we explore with humans and/or robots?

- “...It is imperative for NASA and the National Academies to address how best to improve communication and to resolve conflicts related to robotic exploration of sites with seasonal or persistent liquid water. For planetary settings like Mars with discrete Special Regions rather than oceans, designation of particular areas of these regions for scientific study should be considered.”

Response from NASA HQ at June 7 meeting:

“Concur. We are moving into an era of performing more sample return missions and we need to be better prepared to execute the missions and manage the samples. It is recognized that planetary protection will be a critical technology to accomplish these types of future missions. Therefore, I <Jim Green> am establishing a Planetary Protection Technology Definition Team. PSD will need to make some wise investments into PP technologies and techniques.”

See discussion PPTDT activity in M. Meyer’s presentation at 9:45 AM

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Planetary Science Subcommittee meeting: March 9-10, 2016, findings related to Mars

US Participation in Foreign Planetary Science Missions

- “Other nations are continuing to develop planetary science exploration capabilities and plans, to which NASA can potentially contribute, toward achieving Decadal Survey science goals. PSS urges PSD to evaluate US opportunities to participate in and use data from foreign missions to planetary destinations throughout the Solar System, within the constraints of current State Department restrictions.”

Response from NASA HQ at June 7 meeting:

“Significant partnerships have developed over the last 10 years”

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Planetary Science Subcommittee meeting: March 9-10, 2016, findings related to Mars

Deep Space Network (DSN): PSS alarmed by reports of increasing data losses by active missions while cuts are being made to DSN

Response from NASA HQ at June 7 meeting:

- *“Updates to the PSS on DSN improved tracking statistics were provided on April 29th; We are keeping an eye on this situation. No other complaints have reached our attention.”*
- Notes from Pete Vrotsos presentation at September 29-30 PSS Meeting—
 - Dec. 2015—Feb. 2016 performance summary: no systemic increasing mission data loss greater than the requirements (95% of data returned)
 - 2016 appropriations cut was 3.8% to DSN; no cuts were applied to the day-to-day operations
 - Most anomalies were with the newest antenna at the Canberra complex during 3rd week in January (not driven by obsolescence)
 - Will conduct 90-day study to consider priority of items to be addressed

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Planetary Science Subcommittee meeting: June 7, 2016, findings related to Mars

Communications about Mars Sample Return architectures and ongoing “trade studies”

“...The Committee encourages the PSD to provide:

- (1) frequent updates regarding the progress of these activities to the PSS
- (2) opportunities for dedicated science involvement (e.g., through the use of MEPAG and CAPTEM) in studies regarding sample issues such as encapsulation and preservation, sustainability during cruise, integrity during hard-landing returns to Earth, and optimizing expeditious distribution to sample scientists.”
- *Response from NASA HQ at Sept. 29-30, 2016 meeting:*
 - “Refer to presentations by Mars and Europa Leads. “
 - To be posted on: <https://science.nasa.gov/science-committee/subcommittees/nac-planetary-science-subcommittee>