Initial discussions on Mars white papers for the 2023-2032 Decadal Survey

MEPAG Executive Committee
February 25, 2019

Sol 2291 MSL MAHIL self-portrait (PIA22960.jpg)

Introduction

1) Review of next Decadal Survey (DS) schedule
2) Review of MEPAG's role regarding Mars-related white papers during the last DS (2013-2022)
3) Preliminary suggestions for MEPAG-led community white papers
4) Concepts for how MEPAG can support community members' efforts on white papers

From David Smith
April 2018 presentation at MEPAG #37 meeting:
https://mepag.jpl.nasa.gov/meeting/2018-04/15_Smith-Academies.MEPAG-2018.pdf

Schedule of the Next Decadal Survey

10-12/9/2019	Organizing meeting for 3rd planetary decadal survey
1/2020	Statement of task finalized and survey initiated
3/2020	Chair selected and announced at LPSC
6-7/2020	Survey committee and panel meetings begin
10/2021	First complete draft of survey report assembled
3/2022	Survey report released at LPSC

Likely that a white-paper submission schedule will be released toward the end of 2019.

The National Academies of SCIENCES ENGINEERING MEDICINE

"White Papers"

- A white paper is community input from individuals or groups focusing on important science priorities for the coming decade.
- In 2009, consensus reports representing many individuals were strongly encouraged by the Decadal Survey (DS).
  - "*One of the most important ways for members of the science community to participate in the decadal survey*" (http://sites.nationalacademies.org/cs/groups/ssbsite/documents/webpage/ssb_056163.pdf)
- 199 white papers were received, representing 4,935 individuals.
  - White papers were submitted via the "SolarSystem2012" web site.
- The DS Mars Panel considered > 60 white papers as input to their deliberations
  - Along with past NRC and MEPAG reports, each white paper was read by at least two members of the Mars panel and a summary presented at an early subpanel meeting. If they were considered high priority or very important they were used to request presentations at future meetings to form the input for the Mars chapter of the "*Vision and Voyages*" DS report.

Review of MEPAG's role regarding Mars-related white papers during the last DS (1 of 5)

- MEPAG Chair (J. Mustard) sent letter to community on 4/19/2009, following introduction of DS Chair (S. Squyres):
  - https://mepag.jpl.nasa.gov/reports/decadal/Mars_Community.pdf
  - From Squyres presentation: "*broad community input is a defining feature of a decadal survey*"
  - Mustard's letter included initial discussion on:
    - five white papers to be prepared by MEPAG "*on behalf of the community*."
    - "topical" white papers known at that time to be in development
    - request to keep MEPAG informed of others "*so as to help individual scientists find appropriate places to get engaged*."

Review of MEPAG's role regarding Mars-related white papers during the last DS (2 of 5)

MEPAG-related white papers submitted:

https://mepag.jpl.nasa.gov/reports.cfm?expand=decadal

1) MEPAG (2009a), Why Mars Remains a Compelling Target for Planetary Exploration.
2) MEPAG (2009b), Seeking Signs of Life on a Terrestrial Planet: An Integrated Strategy for the Next Decade of Mars Exploration, J.S. Mustard, ed.
   - This drew in part from the Mars Strategic Science Assessment MSS-SAG (2008): https://mepag.jpl.nasa.gov/meeting/2008-02/MSS_Questions_V12post.pdf
3) Johnson, J.R., et al., Summary of the Mars Science Goals, Objectives, Investigations, and Priorities.

---

4) Banerdt, B., et al. The Rationale for a Long-Lived Geophysical Network Mission to Mars.
   - This was a report from what became the NETSAG (2010): https://mepag.jpl.nasa.gov/meeting/2010-03/NetSAG_MEPAG_Final_v2.pdf
5) Borg, L., et al., A Consensus Vision for Mars Sample Return.
   - This was a report from the ND-SAG (2008): https://mepag.jpl.nasa.gov/reports/ast_2008_0759.pdf
6) Pratt, L.M., et al. Mars Astrobiology Explorer-Cacher (MAX-C): A Potential Rover Mission for 2018.
   - This was from the MAX-C report (2009) of the Mid-Range Rover Science Analysis Group (MRR-SAG): https://mepag.jpl.nasa.gov/reports/ast_2010_0462.pdf
7) Smith, M.D. et al., Mars Trace Gas Mission: Scientific Goals and Measurement Objectives.
   - This was from SDT report initiated by the two Mars Science Orbiter (MSO) SAGs (Farmer et al., 2006; Calvin et al., 2007).

Review of MEPAG's role regarding Mars-related white papers during the last DS (3 of 5)

- MEPAG-requested, technology-centric papers from the Mars Program Office (MPO):

  8) Edwards, C. D. Jr., et al., "Relay Orbiters for Enhancing and Enabling Mars In Situ Exploration".
  9) Hayati, S., "Strategic Technology Development for Future Mars Missions (2013-2020)."

- Community-contributed white papers related specifically to Mars, or those that included Mars as part of an interdisciplinary contribution, are listed on the next two slides:

Mars Exploration Program Analysis Group (MEPAG)

Mars Specific		Interdisciplinary Papers with Mars Categorization	
James W. Ashley	The Scientific Rationale for Studying Meteorites found on Other Worlds	S. W. Ruff	Laboratory Studies in Support of Planetary Surface Composition Investigations
Jeffrey L. Bada	Seeking Signs of Life on Mars: In Situ Investigations as Prerequisites to Sample Return Missions	Eliot F. Young	Balloon-Borne Telescopes for Planetary Science: Imaging and Photometry
Bruce A. Campbell	Exploring the Shallow Subsurface of Mars with Imaging Radar: Scientific Promise and Technical Rationale	J.B. Dalton	Recommended Laboratory Studies in Support of Planetary Science
Vincent F. Chevrier	Laboratory Measurements in Support of Present and Future Missions to Mars	Mark Skidmore	Planetary Science & Astrobiology: Cold habitats for life in the Solar system
Pamela G. Conrad	Geochronology and Mars Exploration: Critical Measurements for 21st Century Planetary Science	Sami W. Asmar	Planetary Radio Science: Investigations of Interiors, Surfaces, Atmospheres, Rings, and Environments
Andrew Daga	Lunar and Martian Lava Tube Exploration as Part of an Overall Scientific Survey	Julie Castillo-Rogez	Laboratory Studies in Support of Planetary Geophysics
Eldar Z. Noe Dobrea	Near-Infrared imaging spectroscopy of the surface of Mars at meter-scales to constrain the geological origin of hydrous alteration products, identify candidate sites and samples for future in-situ and sample return missions, and guide rover operations	Clive R. Neal	Developing Sample Return Technology using the Earth's Moon as a Testing Ground
Jack D. Farmer	Astrobiology Research and Technology Priorities for Mars	Oleksandr Potashko	ATMOSPHERE AS SIGN OF LIFE
John Grant	Future Mars Landing Site Selection Activities	Murthy Gudipati_WGLA	Laboratory Studies for Planetary Sciences
Michael Hecht	The microstructure of the martian surface	Friedemann T. Freund	Previously Overlooked/Ignored Electronic Charge Carriers in Rocks
Michael Hecht	Next Steps in Mars Polar Science: In Situ Subsurface Exploration of the North Polar Layered Deposits	Nathan J. Strange	Astrodynamics Research and Analysis Funding
Steven Howe	The Mars Hopper: Long Range Mobile Platform Powered by Martian In-Situ Resources	David Grinspoon	Comparative Planetary Climate Studies
Naoya Imae	Supporting the sample return from Mars	Andrew M. Davis	Development of Capabilities and Instrumentation for Curation and Analysis of Returned Samples
Michael J. Kavaya	Mars Orbiting Pulsed Doppler Wind Lidar for Characterization of Wind and Dust	Dr. Amy S. Lo	Secondary Payloads Using LCROSS Architecture

Mars Exploration Program Analysis Group (MEPAG)

Mars Specific		Interdisciplinary Papers with Mars Categorization	
Kimberly R. Kuhlman	Tumbleweed: A New Paradigm for Surveying the Surface of Mars	Michael H. Wong	A dedicated space observatory for time-domain solar system science
E. Robert Kursinski	A Dual Satellite Mission Concept for Martian Climate and Chemistry	David R. Thompson	Onboard Science Data Analysis: Implications for Future Missions
Robert J. Lillis	Mars' Ancient Dynamo and Crustal Remanent Magnetism	Carl Pilcher	Astrobiology Priorities for Planetary Science Flight Missions
Michael D Max	Is a Resource-Mars a Stepping-Stone to Human Exploration of the Solar System?	Carl Pilcher	An Astrobiological Lens on Planetary System Science
Michael Mischna	Atmospheric Science Research Priorities for Mars	Charles A Hibbitts	Stratospheric Balloon Missions for Planetary Science
Scott L. Murchie	The Scientific Rationale for Robotic Exploration of Phobos &Deimos	Jeffrey R. Johnson	THE IMPORTANCE OF A PLANETARY CARTOGRAPHY PROGRAM: STATUS AND RECOMMENDATIONS FOR NASA 2013-2023
Dr. David Oh	Single Launch Architecture for Potential Mars Sample Return Mission Using Electric Propulsion	Edward R. Martinez	Thermal Protection System Sensors
Scot Rafkin	The Value of Landed Meteorological Investigations on Mars: The Next Advance for Climate Science	Professor Saumitra Mukherjee	Effect of Star-burst on Sun-Earth environment
Thomas Ruedas etal	Seismological investigations of Mars' deep interior	Robert Grimm	Electromagnetic Sounding of Solid Planets and Satellites
Susanne P. Schwenzer	The importance of (Noachian) impact craters as windows to the sub-surface and as potential hosts of life	John D Rummel	Planetary Protection for Planetary Science and Exploration
Andrew Steele	Astrobiology Sample Acquisition and Return	J. Edmund Riedel	A Survey of the Technologies Necessary for the Next Decade of Small Body and Planetary Exploration
Douglas Stetson	Mars Exploration 2016-2032: Rationale and Principles for a Strategic Program	Reta F. Beebe	Data Management, Preservation and the Future of PDS
Timothy N. Titus	Mars Polar Science for the Next Decade	Michael H. Wong	A dedicated space observatory for time-domain Solar System science
Allan Treiman	Groundbreaking Sample Return from Mars: The Next Giant Leap in Understanding the Red Planet	Barry Geldzahler	Future Plans for the Deep Space Network (DSN)
B. Jakosky	Update: Are There Signs of Life on Mars? A Scientific Rationale for a Mars Sample-Return Campaign As The Next Step in Solar System Exploration	Linda R Brown	Laboratory Spectroscopy to Support Remote Sensing of Atmospheric Conditions
Ethiraj Venkatapathy	Thermal Protection System Technologies for Enabling Future Mars/Titan Science Missions	Walter Harris	Solar System Suborbital Research: A Vital Investment in the Scientific Techniques, Technology, and Investigators of Space Exploration in the 21st Century
Paul Withers	The ionosphere of Mars and its importance for climate evolution		

Perspectives from the Astrophysics DS (started 11/1/18)

- Message from co-chairs of the Astrophysics DS
  - https://aas.org/posts/blog/2019/01/message-from-astro2020-co-chairs
  - "*…encourage scientists at all career stages to participate in the crafting of these important inputs. Mid-career and senior members of the community can help to engage students, postdocs, and other early-career scientists…*"
- NAS Committee on Astronomy and Astrophysics:
  http://sites.nationalacademies.org/cs/groups/ssbsite/documents/webpage/ssb_190176.pdf
  - Included 8 "Thematic Areas" of concentration, with advice that white papers should:
    - *Identify scientific opportunities and compelling scientific themes for the coming decade, particularly those that have arisen from recent advances and accomplishments*
    - *Describe the scientific context of the importance of these opportunities…to the advancement of our broader scientific understanding*
    - *While focusing on science… describe and quantify the key advances in observation, measurement, theory, and/or computation necessary to realize the scientific opportunities within the (next) decade and beyond*
- Notice regarding white papers that are distinct from "science-focused"
  - Astrophysics will request short notices of future intent (NOIs) to submit white papers on *activities, projects, or state of the profession considerations* ("APC") white papers.

Preliminary suggestions for MEPAG-led community white papers: Potential Themes

1) Completion of MSR and resulting science benefits, including status of technology developments
2) Summaries of recently completed Science Analysis Groups (SAGs)
3) Science rationale, goals, and exploration strategies

- *Note: Preparation of "MEPAG-led" white papers does not preclude individuals from contributing separate white papers*

Preliminary suggestions for MEPAG-led community white papers: Examples

1) Completion of MSR and resulting science benefits, including status/plans of technology developments

- Scientific importance of MSR completion in coming decade
  - As described initially in some previous MEPAG reports
- Technical approaches to the required follow-on missions
  - Sample collection (orbiter), Sample retrieval lander, Mars Ascent Vehicle
- Approaches to analyses of returned samples
  - MSR Science Planning Group (MSPG) inputs on sample receiving/distribution/curation
  - COSPAR Sample Safety Assessment Group inputs
    - http://www.hou.usra.edu/meetings/lifeonmars2019/pdf/5028.pdf

Preliminary suggestions for MEPAG-led community white papers: Examples

2) Summaries of recently completed SAGs

- Individual post-2009 SAG-themed reports: https://mepag.jpl.nasa.gov/reports.cfm?expand=smd
  - ICE-SAG (2019): Ice and Climate Evolution Science Analysis Group
  - iMOST (2018): International MSR Objectives and Samples Team
  - MIC-SAG (2017): Mars International Collaboration Science Analysis Group
  - NEX-SAG (2015): Next orbiter SAG
  - SR-SAG2 (2014): Special Regions Science Analysis Group
  - E2E-iSAG (2011): MSR End-to-End International Science Analysis Group
  - SRT-SAG (2010): Supporting Research and Technology Science Analysis Group

Preliminary suggestions for white papers: Examples

3) Science rationale, goals, and exploration strategies

- *MEPAG-led:* Goals Document summary
- *MEPAG-supported*: Integrated Strategy report
  - Response to Mid-term DS panel recommendation for "comprehensive MEP architecture"
    - Including science goals that are addressable by small spacecraft
- *MEPAG-encouraged*: Themes from April 2018 MEPAG forum
  - Ice/Polar studies (climate record, volatiles/dust/energy, ice distribution)
  - Modern/present surface and climate (vapor/dust/ice dynamics, surface changes)
  - Strategies from orbit, surface, and subsurface
    - Volatile reservoirs, mineral distributions, surface dynamics, age-dating, interior evolution, atmosphere evolution, magnetic field, habitable regions, aqueous alteration, stratigraphy, extant life
  - Humans and astrobiology (ice distribution, dust effects), *if requested by DS*
  - Others (?)

Open Questions for the DS charter/scope:

- Role of future humans-to-Mars in the next DS?
- Connections between Mars and Moon exploration?
- Will there continue to be a New Frontiers candidate list?
  - If there is, there are several worthy candidate Mars non-MSR missions
  - Consideration of non-MSR Mars missions should not be limited to Discovery and small spacecraft, although there are also worthy candidates for those programs

Organizing community-contributed white papers (1 of 2)

How can MEPAG facilitate community-led white papers?

- Keep Goals Document contemporary/relevant
  - MEPAG will initiate update following the 9th Mars Conference
- Enable participation
  - MEPAG could provide a googledocs-style spreadsheet for those authors who wish to inform others about white paper topics of interest
  - Could facilitate co-authors, co-signatories, and/or combining of similar efforts among multiple authors under a single entry
    - More signatories were regarded as advantageous by the panels in the last DS

Organizing community-contributed white papers (2 of 2)

How can MEPAG facilitate community-led white papers?

- Communication
  - MEPAG will keep community updated on DS preparations during virtual and face-to-face meetings
  - MEPAG will continue to provide a forum for reports from NASA, other space agencies, MEPAG SAGs, Conferences and Workshops covering Mars exploration
  - MEPAG has been invited to the September 10-12, 2019 meeting of the Committee on Astrobiology and Planetary Science (CAPS)
    - Invitation is to “hear and participate” in planning discussions for the next DS
- Send additional comments/ideas to MEPAGmeetingqs@jpl.nasa.gov

Reference material

From MEPAG #36 Meeting
April 2018

Preparing for the Next Planetary Decadal Survey and the Next Mars Architecture: Things to Remember

- Mars is now a target for many other space agencies and commercial entities
  - ESA, ISRO, CSA, JAXA, China, UAE, SpaceX, etc.
- New engineering capabilities are upcoming
  - Solar Electric Propulsion (SEP), small satellites, sample caching, ascent vehicles, humans (?), etc.
- If only Mars Sample Return is pursued, the consequences could be:
  - a decade-long hiatus of flight investigations
  - a loss of expertise in the Mars community
  - a lack of progress on other compelling scientific/programmatic objectives for Mars (e.g., resources)
    - Need access to competitive programs like *Discovery* and *New Frontiers*
    - Could smaller missions (e.g., a new Mars Scout program) fill the gap?
- Major uncertainties include:
  - Future budgets
  - Relationship of the robotic and human Mars exploration activities
    - Dual-purpose missions? Robotic precursors?

From MEPAG #36 Meeting
April 2018

Preparing for the Next Planetary Decadal Survey and the Next Mars Architecture: Key Factors

- Science-driven Mars Sample Return (MSR) remains a high priority for Mars and Planetary Science
- Newly arrived missions and missions now in development are sure to make new discoveries that will need responses
  - Trace Gas Orbiter, InSight, and the 2020 missions
- Continuing missions (ODY, MER, MEX, MRO, MSL, MAVEN) will still contribute, scientifically and programmatically
  - Major scientific capabilities remain, but need at least level funding to deal with aging spacecraft
- There are several non-MSR science objectives under study that could/should be pursued
  - See this meeting's Forum
  - Small satellite competitions

From MEPAG VM#3 Meeting
September 2018
L. Prockter presentation
on Mid-term DS Review

NASA's Mars Exploration Program (MEP)

Recommendation: NASA should develop a comprehensive MEP architecture, strategic plan, management structure, partnerships (including commercial partnerships), and budget that address the science goals for Mars exploration outlined in Visions and Voyages. The architecture and strategic plan should maximize synergy among existing and future domestic and international missions, ensure a healthy and comprehensive technology pipeline at the architectural (vs. individual mission) level, and ensure sustenance of foundational infrastructure (telecommunications, imaging for site certification, etc.). This approach of managing the MEP as a program, rather than just as a series of missions, enables science optimization at the architectural level. This activity should include assurance that appropriate NASA/MEP management structure and international partnerships are in place to enable Mars Sample Return.