

# Mars Exploration Program Analysis Group (MEPAG)

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## Science Analysis Group (SAG) Planning

Mars Science Laboratory  
View toward path traversed  
Sol 1856 (10/25/2017)  
<https://photojournal.jpl.nasa.gov/catalog/PIA22209>

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## Preparing for the Next Decadal Survey

- A number of potential study activities that MEPAG could undertake to prepare for the next Decadal Survey emerged at the April MEPAG meeting, with its half-day forum and in subsequent discussions, both at the meeting and afterwards by the MEPAG Executive Committee.
- The list is long. The challenge is to identify which activities to pursue in the limited time available. The following slides discuss some possibilities.
- Some prioritization is needed to avoid overwhelming both the science community and the NASA capabilities to do technical studies.
- At the same time, MEPAG wants to encourage community input on all worthy ideas. Participation in MEPAG-sponsored studies and in the writing of reports and white papers are seen as the principal paths.

## Potential study group areas (1 of 2)

- SAG to explore polar landed mission concepts, including stationary lander with polar/astrobiology drill and/or science accomplished from rover missions, including power requirements for surviving Polar night with landed mission
  - Drilling into ice
- Network Mars Drop SAG, one element of which is PolarDrop, among other possible science goals, including survivability of “drop-off” missions.
- Team “X” studies of entire mission/systems, with science as driver
- Analysis of orbital entries/propulsion for Small Sats (Team “A”?), with notional missions to define the requirements

## Potential study group areas (2 of 2)

- How do we evaluate the current/predicted engineering capabilities of small spacecraft over the upcoming decade?
  - How do we identify what can be realistically done with small missions & what compelling science objectives they can achieve given their current rapid technical progress?
- Technology Capabilities: Evaluating key capability gaps and candidate technology investments that would address specific science goals and requirements
- Analysis of CAPS-recommended studies
  - Mars Sample-Return Next-Step Missions
  - Mars Medium-Class Candidates
  - Mechanisms for Conducting Necessary Studies
- SMD/HEO cooperation studies?
  - Trace/connect to MEPAG Goals
  - Differences between lunar and martian exploration



## Potential study group ideas (1 of 6)

- **Polar science:**
  - Desire to build on NEX-SAG & Keck study with dedicated Polar SAG
    - Precedent is Keck Lunar Volatiles study followed by LEAG SAG report.
  - Formulate compelling science objectives for advocacy as NF missions
  - Review, refine & focus Orbiter concepts from NEX-SAG study
  - Develop & prioritize Landed mission concepts. Candidates thus far:
    - stationary lander
    - polar/astrobiology drill
    - science accomplished from rover missions
    - power requirements for surviving polar night
  - Recommend specific concepts to NASA for cost/feasibility analysis

## Potential study group ideas (2 of 6)

- **Network science:**
  - “Drop-off” missions
    - Science goals (e.g., RSLs, PolarDrop), Survivability
  - Multi-rover mission Science goals (already described in earlier SAGs?)
- **Small Spacecraft**
  - Analysis of orbital entries/propulsion
    - Consult C. Mercer from Planetary Exploration Science Technology (PESTO)
    - requires notional missions to define the requirements
  - Current/predicted engineering capabilities and costing analyses
    - see PSDS3 Mars selections for initial examples?
  - Combine the advertised capabilities of small missions with specific science objectives from the community
    - Goal: to generate additional, realistic interest among science community
  - Schedule driver: Make progress before the next SIMPLEX call (as part of SALMON call to be released in May 2019?)

## Potential study group ideas (3 of 6)

- **Technology Capabilities and Needs**
  - Evaluate key capability gaps (e.g., access to extreme terrain, age dating?) and candidate technology investments that would address specific science goals and requirements
    - Start with CAPS recommendations on technologies
    - Interactions with PESTO
    - Cross-cutting with other AG technology needs
    - Cost analyses to reach surface

## Potential study group ideas (4 of 6)

- **Analysis of CAPS-recommended studies**
  - Mars Sample-Return Next-Step Missions
    - Follow-on to “international intent” letter from NASA and ESA?
    - “Operation Readiness Tests” for sample analysis community
      - Purpose: to gain experience with comprehensive, dress rehearsal-style returned sample analyses of all types (air, sand, volatiles, igneous, altered, impact, etc.)
  - Mars Medium-Class Candidates (New-Frontiers class):
    - *This category encompasses several of the existing ideas on this list already. Here is the quote from Table 2 of the CAPS report:*
    - “Multiple mobile explorers, polar explorers, and life-detection investigations, responsive to new discoveries (e.g., the diversity of intact stratigraphies from ancient environments, the detail of the polar record, and the modernity of some liquid water-related deposits)”

## Potential study group ideas (5 of 6)

- **Analysis of CAPS-recommended studies**
  - Mechanisms for Conducting Necessary Studies
    - Sample handling for small instrument analyses
    - In situ, extant life detection technologies
      - Where and how to look for life
      - Themed workshop?
        - » Combined astrobiology and mission technologists
        - » Can be sponsored by MEP and not require MEPAG
  - Fate of samples once returned to Earth (CAPTEM +- MEPAG/SBAG?)
    - *Wait for National Academies Planetary Protection report*

## Potential study group ideas (6 of 6)

- **SMD/HEO cooperation studies**
  - Specific connections between the human lunar exploration program and the follow-on human Mars exploration program (cf. National Space Directive)
  - Trace/connect to MEPAG Goals
  - Differences between lunar and martian exploration
  - Incorporation of science objectives related to humans in Mars orbit
- **Planetary Protection Special Regions analysis in 2019**
  - update of 2014 Astrobiology paper and SR-SAG2
  - *Wait for National Academies PP report*
  - Incorporate recent (Dec. 2017) Induced Special Regions report

## Draft Action Plan for SAGs

SAG Area	Effort Required	Order of Execution	Preferred Completion Date	Comment: Timing	Comment: Scope
Technology Capabilities	L	1	2019Q1	Desired soon	begin with defining capability gaps, consult CAPS recommendations, interact with PESTO, include cost analyses
Analysis of CAPS-recommended Studies	M	1	2019Q1	Want to complete in time for DS white paper submissions Spring, 2020	<ul style="list-style-type: none"> <li>– Mars Sample-Return Next-Step Missions</li> <li>– Mars Medium-Class Candidates (New-Frontiers class)</li> <li>– Mechanisms for Conducting Necessary Studies</li> </ul>
Small Spacecraft	L	2	2019Q2	Complete prior to SALMON call in 2019 (May??)	Combine with Technology section?
Polar Science	M	2	2019Q2	Want to complete in time for DS white paper submissions Spring, 2020	Both lander and orbiter concepts
Planetary Protection Updates	M	3	2019Q3	Wait for NAS PP report 8/31/18	
Network Science	M	4	2019Q4	?	"Drop-off", multi-rover missions
SMD/HEO Cooperation Studies	M	4	2020?	depends on lunar progress?	distinguish lunar/martian exploration



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Thanks everyone for attending

Additional feedback? Email  
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Speak with you next at MEPAG VM #3