

Presentation to  
NASA Advisory Council  
Planetary Science Subcommittee

8 May 2012

**MPPG**

# Agenda Topics

Mars Program Re-Planning 2012



1. Charter
2. Process
3. Pathways
4. Considerations for Early Missions

# Purpose

## Mars Program Re-Planning 2012



- MPPG is a focused study group assembled to:
  - Delineate options for program architectures defined in sufficient detail for NASA to be able to select high pay-off mission(s) beginning with the 2018 launch opportunity
  - Demonstrate visible progress towards the return of samples from Mars, while continuing to advance knowledge and technology in support of exploration of Mars by humans
  - Engage relevant support and expert community groups in the study
- Information will be presented to stakeholders to inform the decision making process leading to a reformulated Mars Exploration Program
- Final study report due Aug 2012

# Guiding Principles

Mars Program Re-Planning 2012



- Provide options for program architectures
  - Sequences of strategically selected and interconnected spaceflight and ground based investigations
- Responsive to the NRC Decadal Survey, and synergistic with progress toward human exploration of Mars
- Demonstrate a strategic collaboration between SMD, HEOMD, OCT, and OCS to leverage capabilities for maximum return on science, technology, infrastructure, and exploration support capability
- Responsive to the President's challenge of human travel to Mars orbit in the decade of the 2030s
- Consistent with the FY2013 President's budget
- Maximize opportunities for engaging the public



# Process

# Core Team & Approach

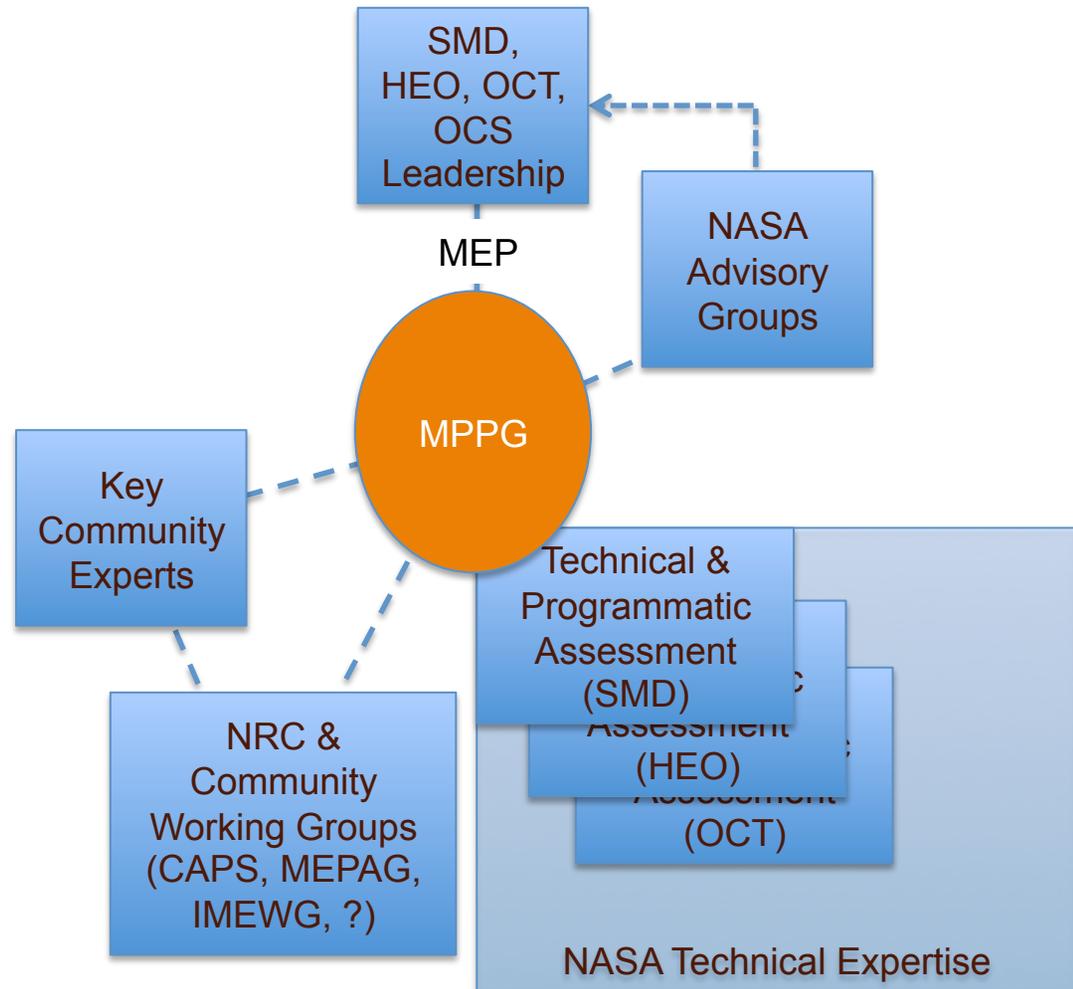
Mars Program Re-Planning 2012



- O. Figueroa (Chair)
- J. Garvin (SMD/GSFC)
- M. Gates (HEOMD)
- M. Gazarik (OCT)
- D. McCleese (JPL)
- J. Mustard (Brown Univ.)
- F. Naderi (JPL)
- L. Pratt (Indiana Univ.)
- J. Shannon (HEOMD)
- G. Tahu (Exec Officer, HQ)

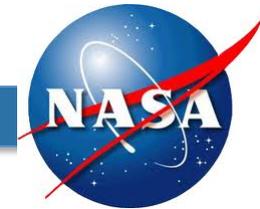
## Ex-Officio

- R. DePaula (SMD/Intl Liaison)
- M. Wargo (HEOMD)



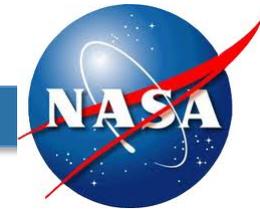
# Figures of Merit for Evaluation

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- **FOM-1:** Degree to which the program *advances overarching scientific goals/objectives of Mars exploration* as stated in NRC Decadal Survey and within the MEPAG Goals document, including provision of surface samples from Mars to Earth laboratories
- **FOM-2:** Degree to which the program *advances knowledge and capabilities required to enable eventual human exploration of the Mars* “system” (orbit, moons, surface), on a time-frame consistent with the President’s challenge (2030’s)
- **FOM-3:** Degree to which the program *infuses technology* developed via Agency-level investments to reduce risk and increase capabilities for robotic scientific and eventual human-based exploration
- **FOM-4:** Degree to which the program maximizes opportunities for synergies and *interconnections between robotic and human spaceflight programs* to increase science yield and to accelerate capability developments (and production of critical knowledge) that support long-term goals
- **FOM-5:** Degree to which each mission and the program as a whole is *cost credible*, and provides flexibility to mitigate programmatic, technical, and scientific risks.
- **FOM-6:** Degree to which the program *provides opportunities for participation*, and leveraging other organization’s (including international) activities, to lowers risks and to enhance and/or accelerate the longer-term goals

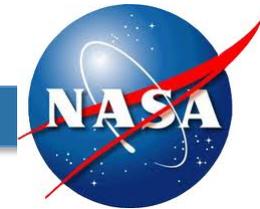




# Pathways

# Concept of Pathways

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- Pathways have been used as a very effective vehicle for strategic planning, analysis, and as a community outreach tool ever since the 2000 Mars Program re-planning efforts
- MPPG is employing them as a vehicle to analyze options
  - FY2013 budget constraints
  - Foundation for a more strategic collaboration between SMD/HEOMD/OCT/OCS towards a common goal
  - New scientific discoveries, ideas, and advances in technology
- Help establish early priorities, common understanding, and intersections
- MPPG using “Samples Orbiting Mars NLT 2033 for return to Earth by humans and/or robotic mission” as a point of possible convergence

# Mars Exploration Pathways



## Mars Program Re-Planning 2012

- Pathways are a series of interconnected investigations
  - Significant advances in the state of knowledge, and the present experience base allow highly focused scientific interrogation, guided by the highest priority objectives
  - Responsive to the NRC Planetary Decadal Survey, including Mars Sample Return
  - Pathways must fit within available FY2013 budget without skipping more than one Mars launch opportunity
- Missions within a pathway are linked
  - Interconnected scientifically and capability wise; orbiters provide operational support as telecom relay and landing site identification, optimization for selection, and certification;
  - Missions feed-forward technology
- Pathways are responsive and driven by discoveries
  - Initiated on the basis of current knowledge
  - Switching between pathways possible, based on emerging new discoveries

Pathway development is currently underway

# Community Inputs to Study Process

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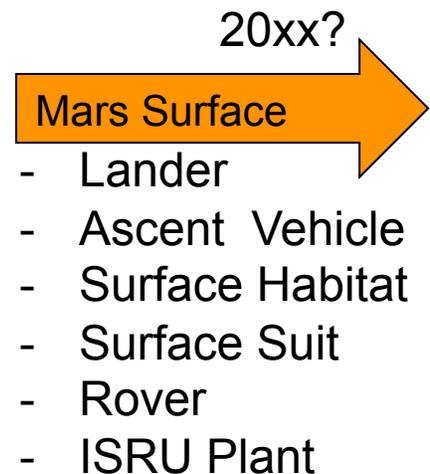
- MPPG science members have reviewed relevant recent studies
  - MEPAG SAG reports, White Papers input to Decadal, published papers
  - Discussed with MEPAG Chairs and Decadal Mars sub-panel chairs
- Adopted targeted interview approach for key questions
  - Identified community subject-matter experts in remote sensing to aide in understanding of priorities aligned with Decadal priorities (and MEPAG)
  - Conducted discussions with several members of the science community regarding orbital reconnaissance, and surface science
- Expanded outreach via individual polling of community experts on landed science (more complicated than orbital)
  - Polling has touched several subject-matter experts on targeted questions associated with what in situ science is essential
- Engaged MEPAG Executive Committee in general discussion of MPPG science to get their views and suggestions

# Humans at Mars Orbit in 2030's

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*Building up system capabilities, gaining deep space operational experience and reducing risk as we move further out into the solar system*



# First Mission Benefits and Considerations

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- First mission opportunity is 2018 or 2020
  - 2018 mission in the \$700 - \$800M class with some adjustments to profile
  - Leverage synergies between SMD, HEOMD and OCT
  - Responsive to the NRC Decadal Survey
- Concepts and considerations
  - An Orbiter
    - Replenish aging infrastructure (Odyssey, MRO); and provide landing site characterization/selection/certification and telecom relay support, new science
    - Pursue science measurements that are high-value for our understanding of Mars and provide information for future human exploration
    - Platform for technology validation: SMD, HEOMD, OCT
    - “Fits” FY2013 budget for an 2018 LRD
  - A Lander
    - Provide the opportunity to investigate and select samples suitable for return to Earth from a compelling site, chosen based on best available information
    - Pursue high value science, and address knowledge gaps for human exploration
    - Platform for technology validation: SMD, HEOMD, OCT
    - Stationary lander may be possible in 2018, but first opportunity for a roving mission would likely be 2020 without FY2013 budget augmentation

# Near Term Plans

## Mars Program Re-Planning 2012



- Finalize early mission concepts and options
  - Orbiter, lander/rover, and synergies with technology and human exploration requirements
- Finalize initial set of pathway options
  - Focus on mission concepts for early (2018/2020) opportunities—orbiter and lander
  - Integrate HEOMD and OCT priorities in areas of technology and capabilities
  - Initiate independent assessment for cost realism (Aerospace)
  - MEP integrating requirements and cost profiles into PPBE process
- Expand community inputs (PSS, MEPAG, NRC/CAPS) and international engagement, and conduct LPI Mars workshop
- Continue communication with stakeholders as work progresses
- Information will be shared for review and assessment as MPPG work matures

# Summary/Discussion



## Mars Program Re-Planning 2012

- Orbital reconnaissance is valuable if it sustains and extends MRO capabilities with direct relation to MSR-related goals (Decadal). Payload concepts evolving into two tiers:
  - Core competed payload of essential measurements
  - Enhanced science (competed) that could extend capabilities and synergies tied to NRC Decadal Survey priorities
  - New discoveries will influence aspects of the strategy/payload
- Community impression is that early landed science is most highly desired if it can retain path to MSR
  - Details are still in development for early landed missions, but roving is the key desire/need together with access to high priority sites
- PSAG analyzing priorities in human exploration knowledge gaps
  - Can be applied to orbiter and/or lander concepts
- Community leaders polled generally pleased with MPPG as more detail is being unveiled