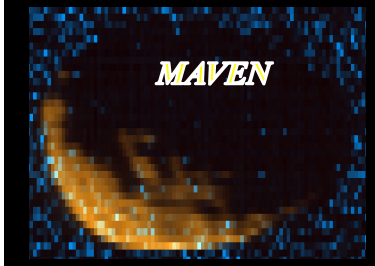
Mars Exploration Program Analysis Group (MEPAG)

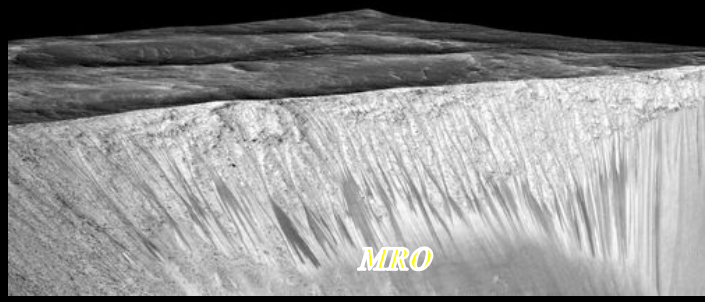
chartered by NASA HQ to assist in planning the scientific exploration of Mars

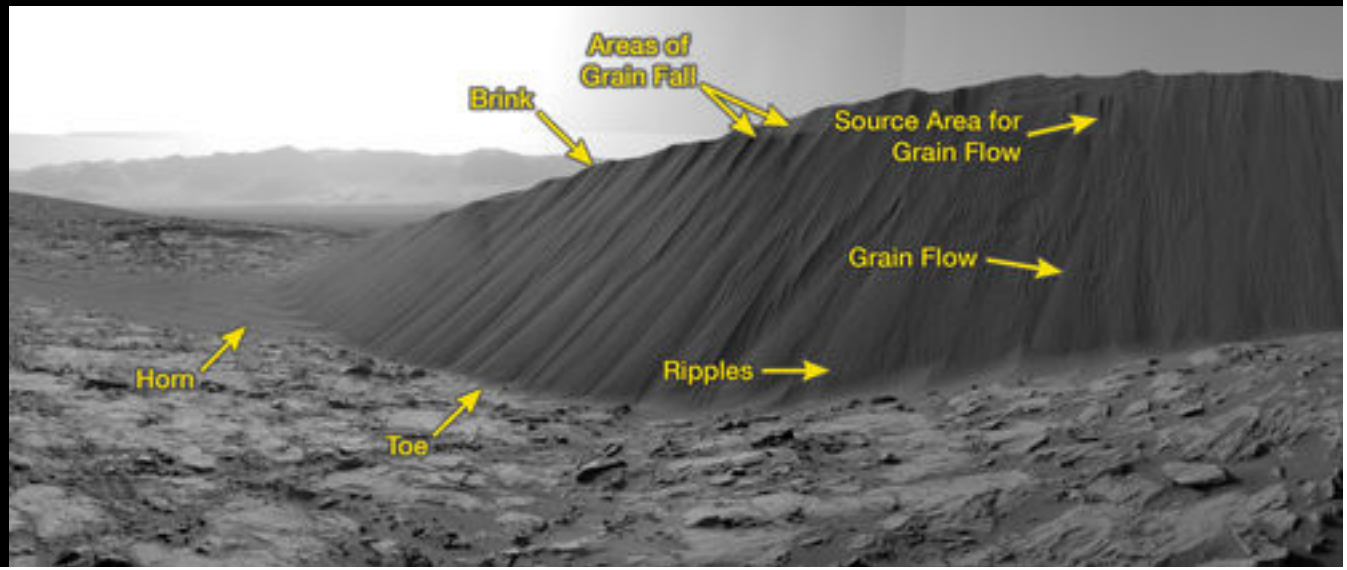


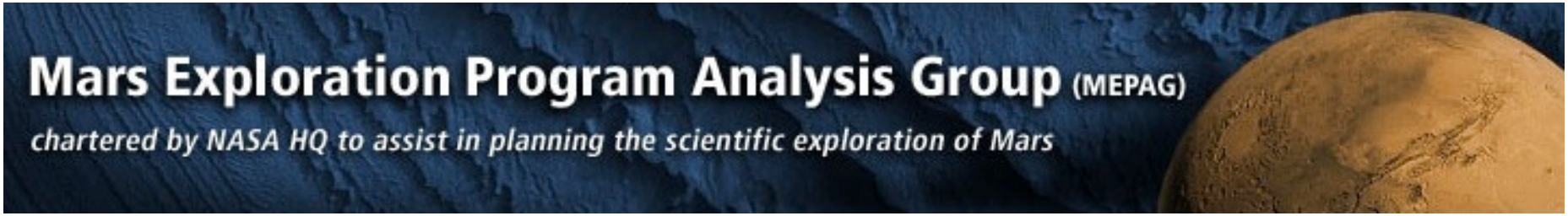
Lisa Pratt, *MEPAG Chair*

Report to PSS

March 10-11, 2016

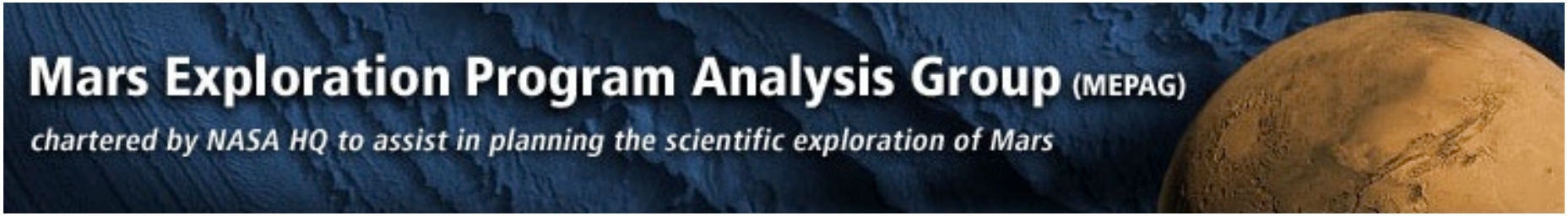






Mission Status Highlights

- *Curiosity* is moving on from its several-month investigation of the Namib (part of Bagnold dunes)
- MRO and ODY are stepping up observations as data rates increase
  - Both orbiters have started observing candidate sites (exploration zones) for humans on Mars
- MER-B has survived winter and is exploring area where orbital data indicate clays
- MAVEN has finished prime mission; special issue out with 59 papers reporting results
- Foreign collaborations with ESA Mars Express and ExoMars MOMA continuing
- 2020 Mars rover passed PDR review but has not gone through the Directorate or Agency Program Management Councils



MEPAG Face-to-Face Meeting held March 2–3

- **New MEPAG Chair**: Jeff Johnson (JHU-APL)
  - Lisa Pratt moves to MEPAG Executive Committee
  - Nominations invited to fill vacancies on Goals Committee
- **Wide-Ranging Presentations and Discussion**
  - Reports from PSD, MEP, and several space agencies
    - Including report from IMEWG iMARS coordination study
  - Overview of joint HEO-SMD activities
    - Successful first workshop for landing sites (Exploration Zones) for humans on Mars held October 2015
  - MEPAG accepted two reports from its Science Analysis Groups
    - Science Objectives for Human Explorers on Mars (HSO-SAG)
    - Next Mars Orbiter (NEX-SAG)

Next Mars Orbiter (1 of 3)

- **MEPAG endorsed the NEX-SAG report which concluded:**
  - z M'rs Prflitere utilizing Solar Electric Propulsion (SEP) and advanced telecom in a 5-year mission in low Mars orbit, could provide exciting new science and resource identification
- **A mission with SEP could have the capability for return of a cache of Mars samples to Earth vicinity as well as payload elements addressing high-priority resource and other science objectives**
  - Return capability addresses the need to make progress on sample return, which is the Decadal Survey's highest priority for flagship missions. However, the MEPAG community hopes that the next Mars orbiter will also host remote sensing instruments observing Mars.

Next Mars Orbiter (2 of 3)

- **MEPAG is encouraged by inclusion of $10M in the President's FY17 budget to study the next Mars mission.**
- **MmPAG agrees with the importance of replenishing relay and site certification infrastructure to support future missions.**
  - MEPAG recommends making every effort to enable new, compelling science from orbit in addition to the rendezvous/capture/return capability
  - NEX-SAG identified several possible science and synergistic resource identification objectives.

Next Mars Orbiter (3 of 3)

- **MEPAG is encouraged by MEP's efforts to work with other NASA directorates and with international partners to include payload elements to achieve synergistic science and resource objectives that a SEP orbiter mission to Mars could support.**
  - Wherever possible, payload elements should be solicited through a competitive peer review process
  - Contributed payload elements should be critically reviewed to ensure key objectives can be met
  - MEPAG community is concerned about opportunities for the U.S. science community to compete and be involved in achieving these science and resource objectives

International Mars Exploration (1 of 2)

- **MmPAb commends the exciting Mars opportunities being considered by the world community:**
  - India's successful MOM mission and ISRO's opportunities for collaboration with contributions to U.S. 2020 and/or U.S. contributions to ISRO missions
  - Imminent launch of ESA's ExoMars Trace Gas Orbiter and onging development of a 2018 lander/rover mission with ~2m depth drill capability
  - UAE's ongoing development of a 2020 Mars orbiter
  - JAXA's mission design study of a Phobos sample return
  - Discussions between PSD/MEP and other space agencies regarding collaboration and flight of instruments provided for one another's missions

International Mars Exploration (2 of 2)

- **MEPAG recognizes that international collaboration can enable significant advances in exploration, particularly in a time of tight space agency budgets.**
  - Report from iMARS and the International Mars Exploration Working Group (IMEWG) deserves careful study of how best to conduct sample return for flight missions and the analysis procedures once samples are on Earth.
  - Now is the time to build the international partnership that will result in the return of samples to Earth.

Exploration by Humans on Mars (1 of 2)

- **The last year has seen considerable and productive progress in joint HEO-SMD activities to assist planning for missions with humans on Mars.**
  - ***HSO-SAG*** identified key science objectives for human explorers on Mars and enabling technologies
  - ***NEX-SAG*** identified proof-of-concept instruments that could aid resource location and fill SKGs on a 2022 orbiter with SEP. Such instruments would be synergistic with science
  - ***Landing Site for Humans Workshop*** and follow-up requests for reconnaissance by MRO and ODY

Exploration by Humans on Mars (2 of 2)

- **MEPAG believes this joint activity has been productive and is ready to support additional joint study where HEOMD and SMD agree that it is productive**
  - In-depth studies of candidate landing sites for humans will require funding by the appropriate parties
- **While supportive of these joint studies, MEPAG believes it is imperative that MEP continue to plan and implement a "robotic" Mars exploration program**
  - Support the continuing exploration of Mars by ongoing missions
  - Continue to make progress on sample return
  - Continue to look for opportunities to further our scientific understanding of Mars without waiting for funding contributions from HEOMD

- **MEPAG hopes that PSD (and Congress) will support *InSight* for flight in 2018**
  - MEPAG recognizes that finding the needed funds is a challenge
  - However, this mission addresses fundamental Mars and terrestrial science questions of how planets form and evolve.
- **Looking ahead to humans on Mars and given the emergence of special region candidates, Planetary Protection policy needs continued examination.**
  - PP procedures need greater consideration of human presence on Mars.
  - If water is to be a resource for humans on Mars then we need ways to explore at least some special regions as science targets.

Extended Missions

- **All PSD/MEP continuing missions are being assessed this spring as part of the PSD Mission Senior Review; furthermore, an NAS committee is examining issues related to extended missions.**
  - MEPAG hopes the enormous value (science gained for the funds expended) of extended missions will be recognized and that high-quality science will continue to be supported

Miscellaneous

- **MEPAG clearly supports ongoing R&A and Data Analysis programs**
  - R&A and Data Analysis is where the mission data are fully exploited to gain scientific knowledge and to guide future mission development
  - MEPAG notes that as operating mission budgets are squeezed, more work must be done under R&A and DA
- **Urgent need for adequate funding to support U.S. investigators on foreign instrument teams, whether on U.S. or other missions**
  - A path for competing for whatever funds are made available (SALMON?) should be clearly described to the community

Looking Ahead

- **TGO launches March 14 and arrives at Mars October 19**
- ***Objectives and Requirements Definition Team* (ORDT) for a 2022 Mars orbiter sometime this FY**
- **Virtual MEPAG meeting in the Fall this year**
- **Formulation of new SAGs to start in the Fall. Possibilities include (but are not limited to):**
  - Follow-up on HSO SAG by examining what *Mars* science could be done with humans in orbit or on Phobos
  - Study what Mars science could be accomplished by small satellites in Mars orbit or to the surface and what infrastructure they would need