National Aeronautics and
Space Administration

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Reply to Attn of: 239-4

November 15, 2010

Ron Greeley, Chair
Planetary Science Subcommittee
Science Advisory Council
School of Exploration
Arizona State University
Tempe, AZ

Dear Dr. Greeley,

This letter reports on MEPAG's meeting on September 30 to October 1, 2010 in Monrovia, CA. Attendees numbered 153, including representatives from multiple NASA centers, NASA-HQ, academia, government, contractors, foreign space agencies, and the press. WebEx was used to webcast the meeting, and all of the materials used during the presentations have been (or will soon be) made available to the larger community through the MEPAG web site (http://mepag.jpl.nasa.gov/).

Key discussion topics for the meeting reflected ongoing developments related to the Mars architecture previously endorsed by MEPAG. This included status reports on the emerging NASA-ESA joint mission initiatives for Mars, the work of the NRC Decadal Survey's Mars Panel, as well as early exploration of possible interactions with NASA ESMD as it considers possible robotic precursor missions that may pave the way to future Mars human missions. The MEPAG Executive Council announced the formation of the End-to-End International SAG (E2E-iSAG) to articulate the science objectives that could drive the overall MSR campaign, culminating in the study of the returned samples. The MEP outreach program was summarized. These and other items are described in more detail in the following paragraphs.

1. Mars exploration status, discussion.

- NASA. Doug McCuistion announced that preparations have begun for the biennial Mars Exploration Program (MEP) Implementation Review, which is scheduled in late April, with approval anticipated in May. The NASA-ESA Joint Mars Exploration Program (JMEP) will be a key part of this implementation plan. Doug also indicated how ongoing developments in the management structure for this program emphasize close coordination at several levels: science (MEPAG, Joint Instrument and other Study Teams), engineering (Joint Engineering Working Group), management (Joint Mars Executive Board), and review (Joint Mars Architecture Review Team). The draft MOU is in near-final form. Michael Meyer reported on activities within SMD, which highlighted the role of MEPAG as a forum for science community input. He also noted the role of MEP in the upcoming "Year of the Solar System", including MSL landing site selection and launch. Fuk Li (Mars Program Office)

reported on the substantial progress of MSL with integration of rover components and initial testing of the robotic arm and with the last instrument on schedule for delivery in December. MAVEN successfully passed its PDR last summer. (The MAVEN confirmation review was held shortly after the MEPAG meeting, and the project has now entered Phase C.)

- ESA. Jorge Vago presented an overview of ESA's perspective on and the current status of the proposed NASA-ESA 2016 and 2018 missions, including their science elements. ESA has defined several studies for post-2018 missions in preparation for the 2012 Council of Ministers meeting: a network science mission, sample return from Phobos or Deimos, Mars atmospheric sample return, a precision lander with sampling/fetch rover, and an MSR orbiter. He also announced "Mars Week" in Europe, June 12 to 21, 2011, which will feature the conference "The Exploration of Mars Habitability" and the 1st International MEPAG meeting in Lisbon, Portugal, with an associated field trip to Rio Tinto, Spain.
- EMTGO/EDM. Jorge Vago (ESA) and Phil Crane (NASA) presented the process and results of the joint selection of a scientific payload for the proposed 2016 ExoMars Trace Gas Orbiter. Five instruments were selected; four led by U. S. Principal Investigators (two with major hardware contributions from international partners) and one from Europe. In November, ESA will issue an AO for a small science package (3 kg, 8-sol surface lifetime, 50 Mbits of data returned on a single pass) that may be included on the ESA ExoMars EDL Demonstrator Module (EDM). In a subsequent mailing, NASA has declared its intent to consider supporting team membership, but not instrument hardware development, in response to the upcoming EDM AO.
- MER Spirit. Steve Squyres participated via teleconference to describe the science objectives for the Spirit rover, should it awaken and call home after its winter hibernation. Several months of tracking Spirit's X-band transmission signal would be used to determine the time-dependent spin-axis direction (precession/nutation) of Mars and thereby constrain size, state, and density of the core of Mars. This could provide insights into the evolution of terrestrial planets and also provide information about the nature of an early global magnetic field on Mars. Spirit would also conduct additional observations of Scamander crater, where an intriguing mix of soil components may indicate several episodes of water activity, some of which might have occurred relatively recently.

Discussion: Most of the discussion that followed addressed the proposed joint NASA-ESA activities. This collaboration offers clear advantages that include cost-sharing and pooled expertise. However, challenges were also noted.

Concerns re: NASA-ESA Joint Missions

– Completing the MOU and Joint Program Exploration Plan (JPEP), which is critical for stability

– Meshing different agency cultures

– Completing 2016 early NASA milestones since ESA has a "head start" and NASA funding for 2011 is tight

– Reconciling mismatches between the EXM and MAX-C rovers, e.g., latitude constraints

– Maintaining partnership after the first two missions through Mars Sample Return

2. SolarSystem2012 Decadal Survey

Steve Squyres provided an overview of the Solar System Decadal Survey and summarized its current status. The survey will likely make recommendations on NASA program balance (mix of mission targets and sizes, research), NASA-funded research activities, and technology developments. The Survey will also present prioritized lists of New Frontiers and Flagship missions. The draft report has been completed and sent to a select group of reviewers. Details

concerning these recommendations are embargoed until they are publicly presented at LPSC in March 2011.

3. Planetary Science Subcommittee SR&T Study

David Des Marais announced the NAC Planetary Science Subcommittee (PSS) study of the SR&T and related activities to assess program relevance and effectiveness, and to suggest possible improvements in program management. Ron, as you are coordinating this effort, no further details are necessary here! Dr. Victoria Hamilton has agreed to coordinate MEPAG's recommendations regarding research activities that are most effective and important to the vitality of MEP. Inputs should be submitted by the end of the calendar year.

4. End-to-End International Science Analysis Group (E2E-iSAG)

As co-chair (with Mark Sephton), Scott McLennan introduced this new SAG, which is chartered to articulate scientific objectives and priorities for the overall multi-mission MSR campaign, culminating in the study of the returned samples. Key objectives are to propose reference campaign-level MSR science objectives and priorities, and to analyze the implications derived from them. These implications will flow into requirements in the following areas: kinds of samples, capabilities for sample acquisition and handling, site selection criteria (illustrated by reference landing sites), and *in situ* capabilities needed for sample selection. This effort is very timely because MEP must be prepared to act upon any Decadal Survey's recommendations regarding a 2018 mission. Specifically an SDT for a 2018 mission would need to be initiated by mid-2011 in order to support the mission development timeline. Also, the key orbital assets that are required to support a 2018 landing site selection are aging, therefore the selection process should proceed in the near term. This international SAG is jointly sponsored by NASA and ESA, and the SAG membership is split 50-50 between North America and Europe. An initial report from this team is expected by the time of the AGU, with a full report in Spring 2011.

5. Mars Outreach Program

Michelle Viotti provided an overview of MEP's dynamic and diverse outreach program. The program stresses "evidence-based outcomes" as indicators of its effectiveness, rather than merely "outputs and products." She cited several success stories in this regard. Key examples included cases of "participatory exploration," where students and the public can view exploration operations directly, acquire and work with images and data, interact with mission personnel, and even make recommendations. Participation by professional educators and education psychologists has substantially benefited the program. The presentation was well received and was followed by an extended discussion of personal experiences and suggestions.

6. ESMD Exploration Precursor Robotic Missions (xPRM)

Mike Wargo provided an overview of the xPRM effort, which consists of two mission programs (xPRP and xScout) that are traceable to the human spaceflight (HSF) priority objectives and needs for safety, sustainability, capability and planning. xPRP consists of linked flight missions, instrument developments and R&A that acquire precursor knowledge for human spaceflight (cost: $500M to $800M for total life cycle, including launch). xScout consists of focused, less expensive higher-risk missions ($100M to $200M total cost, including launch). Although xPRM missions are driven by HSF objectives, a collateral benefit is anticipated with SMD missions,

which are, of course, driven by science objectives. Accordingly ESMD seeks to coordinate with other NASA directorates, emphasize competition in their own mission selections, foster opportunities for international collaboration, and create participatory exploration opportunities. Examples of potential missions (subject to change) during the coming decade include spacecraft sent to near-Earth asteroids, the lunar surface, and Mars and its vicinity.

Concerns re: xPRM

The budget for this program, and therefore its content and scope, is currently uncertain. Furthermore, it will be difficult to develop xScout missions for deep space (e.g., Mars) given their mission cost caps.

It will be challenging to identify Mars missions that provide collateral benefits for ESMD and SMD and that are also viable in the near term.

7. Landing Site Selection – MSL and subsequent missions

Matt Golombek summarized the highly successful MSL landing site selection workshop that concluded just prior to this MEPAG meeting. Well over 150 participants from the science community and MSL science teams attended the 3-day workshop. Science presentations revealed that all four of the finalist sites have great science potential and should continue to be considered as MSL candidates. The presentations and summary comments are posted on the Marsoweb web site. All of these sites are presently considered safe with respect to EDL and traversability. Thus, they will be evaluated with respect to the richness of the science targets that can be addressed through the combination of mobility, remote sensing and *in situ* analytic capabilities during the nominal mission duration of one Mars year. Golombek also described the call for additional landing sites to be targeted by orbital assets and to be considered for missions subsequent to MSL.

Charles Budney described the competitive program to fund investigations to acquire critical data products for landing sites for future missions, whether MEP strategic missions (e.g., the 2018 dual rover mission now under study) or for competitive programs like Discovery. A call for proposals will be issued in the fall of 2010, with the possibility of a second call in summer of 2011, with the expectation that 10 to 20 investigations will be funded at $25K per investigation.

Rich Zurek described current orbiter capabilities for landing site selection. His summary of the currently functional instruments indicated their remarkable capabilities and achievements, but he also stressed that they have finite lifetimes. Thus, a system of triage may be necessary for determining which sites have priority with what level of characterization by current orbiters.

Concern re: Landing Site Selection

MEP must move aggressively on a near term program of site selection for post-MSL missions.

8. MEPAG Goals Committee

Jeff Johnson summarized recent revisions of the MEPAG Goals and Objectives. The recent revision of Goal I (Life), led by Tori Hoehler and Frances Westall, has been finalized, approved, posted on the MEPAG website and will be published in the journal *Astrobiology*. The recent revision of Goal IV (Human Exploration), led by Abhi Tripathi and Darlene Lim, has been finalized, approved, and posted on the MEPAG website. Some relatively minor revisions to Goal III (Evolution of surface and interior) are currently in progress.

In summary, it was an exciting meeting touching on a vibrant program of spacecraft operating on Mars, on preparations for future missions, including the launches of MSL next year and of MAVEN in 2013, and on real progress in shaping the form—both scientific and programmatic—of a joint Mars program with ESA.

Please don't hesitate to contact me if you have any questions.

Sincerely

David J. Des Marais

Cc: Doug McCuistion
Jim Green
Fuk Li
Michael Meyer
David Beaty
Rich Zurek
Joyce Pulliam, for forwarding to the MEPAG mailing list