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Dr. Michael Meyer
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Washington, DC 20546

Dear Michael,

On behalf of the Mars Exploration Program Analysis Group (MEPAG) Executive Committee, I am reporting to you on the results from the MEPAG meeting held in Arlington, VA, on 16-17 February 2005. According to our attendance records, 166 people attended the meeting, including scientists and representatives from many of NASA's field centers, from NASA HQ, from major research universities, from the aerospace industry, and from private research organizations around the country. This was the first meeting MEPAG has held on the East Coast since Oct. 2001, and we were greatly encouraged by the strong turn-out.

The major goals of the meeting were:

- To discuss the status of the Mars program with program leaders from NASA HQ and JPL;
- To discuss the status of the NASA Roadmapping process and the Mars Roadmapping committee;
- To discuss the draft report from the MEPAG Mars Sample Return Science Steering Group that has been revisiting the science requirements for the MSR mission in light of recent science results and changes in direction; and
- To discuss results from the MEPAG Mars Human Precursor SSG and the revision of the "human exploration" component of the Mars Science Goals and Objectives document.

In addition, a number of other items of importance were on the agenda. Below, we summarize the highlights from the meeting, including issues and concerns that were raised both in the meeting and by the Executive Committee.

Status of the Mars program

MEPAG heard presentations from Doug McCuistion (Mars Program Director) and from you regarding the status of the Mars program, future activities, and future directions. In particular, we had the opportunity to engage in an extended discussion with Doug regarding the program, with questions ranging from the very specific to the general. MEPAG continues to be enthusiastic about the current vigor of the program and the directions in which it is headed, while

at the same time having concern about the uncertain future of the program in the face of the reinventing of NASA that is currently ongoing.

Concerns were voiced regarding the apparent absence of scientific oversight of the Mars program. While there are no specific complaints or major concerns about the program, it is seen as a problem that there is no independent oversight of the Mars program along the lines that the SSES provides for the broader solar-system program. While SSES nominally has purview over Mars as well, the small number of members of that committee who are cognizant of the Mars-related issues, and the small amount of time generally available to discuss Mars, preclude its providing true oversight of the program. Appropriate oversight could be provided by an expanded SSES or by a separate Mars-oriented committee that reports directly to SSAC. (Committees such as COMPLEX or the Space Studies Board within the NRC structure provide general oversight, but do not have the ability to respond sufficiently quickly to deal with a large and changing program such as the Mars program.)

At the same time, there is a need for increased visibility within SSES and SSAC regarding the Mars program and MEPAG activities. Those committees have nominal oversight of the Mars program, yet have not been taking advantage of the detailed analyses being carried out by the Science Steering Groups (SSGs) within MEPAG. There would be significant value in having more-formal interaction between MEPAG and these committees. It is important, however, that any increased connection not detract from the major functions of MEPAG (i.e., maintaining the Scientific Goals document, chartering and running SSGs that provide interaction between the science and engineering/mission planning communities, providing a forum for interaction between the science community and the program leadership at NASA HQ and JPL, and maintaining electronic communications with the community).

In addition to strengthening ties between the Mars program and the rest of solar-system exploration, there would be real value in strengthening ties between the robotic and human programs. At present, there is confusion about the relationship between the Science Mission Directorate and the Exploration Systems Mission Directorate and where Mars fits into this relationship given the compelling interests of each. In particular, it is not clear that there is sufficient science input being provided into the ongoing Mars-related planning of the ESMD. While MEPAG can address this concern by forming an SSG that would address the science aspects of the human program (see below), enhancing these connections at NASA HQ would increase the visibility of the science significantly.

The possibility was raised that a Scout or Scout-class mission might be developed for 2009 launch to fill a possible gap in the program in the event of a delay of the 2009 Mars Science Laboratory mission to 2011. Concerns were raised about the very short timescale and the difficulty of putting together a credible Scout mission proposal that would be based on sound science on that timescale; one alternative would be to include a Scout-class mission as part of the core program, although there are concerns here as well about developing the science theme in such a short period. While we would hate to lose the opportunity for a science-based mission to be inserted in this decade, we want to ensure that it has an adequate and appropriate science basis and that there is sufficient time to develop it to maximize the chances for success.

Finally, there is a serious concern over the implications for the science program of the removal of the "firewall" for transfer of funds between the Science Mission Directorate and the rest of NASA. Whether cuts are focused on a single program or distributed across the entire science program, any losses associated with transfers out of SMD would represent an erosion of scientific expertise that would be difficult to replace at a later time. While there clearly is a need to fund existing programs and to be able to move forward in agency-wide planning, there is the need at the same time for a balanced program that contains appropriate support for both human and robotic exploration programs. As a science issue, we hope that consideration is being given at the highest levels within NASA to developing an appropriate balance in these programs that can be sustained over a long period.

Report on the Ongoing Roadmapping Process

MEPAG heard two presentations related to the Roadmapping process, one from Dan McCleese on the Mars Strategic Roadmap, and one from Rich Barney on the Instruments Capability Roadmap. The attendees listened with rapt attention to the Mars report; however, there were no questions put to MEPAG, so we did not generate any formal feedback. For the instruments presentation, comments suggested that insufficient consideration had been given to the development of instruments needed to support sample-return missions. The analysis also appeared weak in the area of in-situ instruments and in sample preparation systems, both of which will be very important to the Mars program in the next 10-15 years.

Preliminary Report of the MSR SSG

MEPAG heard a detailed discussion of the Mars Sample Return SSG report, which currently is in draft stage, and engaged in a lively discussion of the details and specifics. Recall that this SSG has been meeting for the last several months under the leadership of Glenn MacPherson of the Smithsonian Institution. Its charter was to revisit the conclusions of the 2002 "Groundbreaking MSR" report in light of (i) the tremendous operational and scientific successes of the MER missions, and (ii) the new directions and opportunities provided by the space exploration vision currently being implemented at NASA. The MSR SSG presented the issues and ramifications within the four themes of mobility and accessibility, sampling and sample handling, forward organic contamination, and forward inorganic contamination.

The SSG concluded that the following changes to the GB-MSR concept are its highest priority (not listed in priority order):

- Significant mobility, with a minimum travel distance of ~ 1 km just to escape exhaust halo, go somewhere nearby, and return.
- Accessing outcrops along crater walls (e.g., as at the Meridiani site) or inclined hill slopes (e.g., Columbia Hills) requires ability to negotiate slopes of ~ 30^{o}
- Landing precision needs to be within 500 m of a selected location.
- Highest sample acquisition priority is the use of appropriate sampling tools. The ability to sample outcrop stratigraphy (as with a simple corer) is critical.

- Highest sample handling priority involves sub-sample separation.
- It is desirable that MSL should cache samples for retrieval by MSR, but this should NOT be a requirement for either mission.
- There is significant sample degradation at temperatures of 50 ^{o}C, and possibly unacceptable degradation down to 20 ^{o}C.
- Total organic contamination needs to be kept to <10 ppb in the isolated clean subset of samples, and at levels recommended by the OCSSG in all other samples.
- Inorganic contamination levels should be coupled to acceptable levels relative to their abundances in the SNC meteorites.

The conclusions listed above were well-received by the MEPAG audience. The major outstanding issue is how these science priorities will flow forward into mission requirements (i.e., the "science floor" for the mission). MEPAG is well aware that adding requirements may make the mission unaffordable, but at the same time, given recent results, MSR probably is not credible without at least some of these features. This is a difficult trade-off, and we note that setting requirements is a program, rather than a MEPAG, function. The MEPAG Executive Committee is reviewing the draft white paper submitted by the SSG.

Preliminary Report of the MHP SSG

MEPAG heard a detailed presentation from the Mars Human Precursor SSG, which we formed at the last MEPAG meeting at the request of ESMD. This SSG has prepared a major recommended revision of MEPAG's Goal IV (pertaining to precursors to human missions) that involves significant changes in both content and priority.

The MHP study involved a very large number of people—more than 100 scientists and engineers, and a significant number of them were in attendance at this MEPAG meeting. Overall leadership was supplied by David Beaty (Mars Program Office), Noel Hinners (Colorado), Kelly Snook (now at HQ), and Bobby Braun (Georgia Tech). The SSG was split into two parts to assess separately the two objectives within Goal IV (measurements and technology/infrastructure), and within that a sub-team organization was established to consider the high-priority technical issues in sufficient detail. These subteams included issues related to biohazard risk, atmospheric risk, radiation risk, dust/regolith risk, terrain/trafficability risk, transit issues, EDL issues, surface operations issues, and science planning issues.

The discussion included short presentations on most of these topics, followed by a 45-minute panel discussion. Although a number of interesting details were raised in discussion, no significant issues that would affect the acceptability of the analysis were raised. Prior to considering acceptance of this overhaul of Goal IV, the MEPAG Executive Committee plans two further validation steps: First, the proposed revised listing of Goal IV investigations and measurements has been sent to the entire MEPAG e-mail list (1700 people), and they have been given a chance to comment. Second, we will seek formal review of the white paper prepared by the SSG. We propose in addition that a special workshop be held which will focus on the exploration engineering community.

Launching of an "on-line" Mars journal

Prof. David Paige of UCLA presented MEPAG with plans for creating an "on-line" electronic Mars scientific journal, with a broad emphasis on Mars scientific results, policy discussions, and technology development directions. This on-line journal is an experiment that has the potential to bring the entire Mars community together and to provide a focal point for Mars-related activities. A number of concerns were raised about the status of the implementation. We are communicating these to him separately, as a way of encouraging him and trying to help him find solutions that will ensure the long-term success and viability of the journal.

MEPAG Relationship with Lunar Exploration Analysis Group (LEAG)

Prof. Jeffrey Taylor (Univ. of Hawaii) described to us the status of the Lunar Exploration Analysis Group (LEAG), which recently held its first meeting. LEAG was created as a parallel to MEPAG, but with a combined emphasis on both the science and exploration aspects of going to the Moon. There is universal agreement that strong coordination between LEAG and MEPAG will be valuable, given that the Moon and Mars programs are connected by the NASA vision that is being implemented. We wish to encourage coordination and interaction. We will be pleased to have the LEAG chair (or representative) serve as either an Ex Officio member of or a formal liaison with the MEPAG Executive Committee, and to appoint a MEPAG representative to act as liaison with the LEAG Executive Committee. More broadly, we see real value in having occasional discussions between the chairs of all of the activity groups, including the recently chartered Outer Planets Activity Group.

Specific activities that could be developed as joint efforts between MEPAG and LEAG might include a joint SSG dealing with in-situ resource utilization (ISRU). Such a joint effort could involve a joint SSG or parallel SSGs that coordinate their activities. Other activities might include efforts aimed at understanding the potential for activities involving humans carrying out research in these extreme environments or in utilizing activities at the Moon to prepare for activities at Mars.

MEPAG directions for the coming year

Based on the directions of the Mars program and the programmatic needs for science input as we understand them, we discussed four new Science Steering Groups that could be formed over the next year. These are:

- Scientific implications of atmospheric trace gases. This would address the potentially biogenic gases that might be present at detectable levels in the martian atmosphere, necessary measurement requirements and capabilities, and scientific implications.
- Deep-drill mission. This would define the scientific objectives of a robotic deep-drill mission that could be carried out in the second decade, the technological requirements for such a mission, and the development necessary.
- Science goals for human missions. This would revisit the science goals that could be addressed by the first human missions to Mars some 25 years from now, in order to provide appropriate input into the ongoing planning within the Exploration Systems Mission Directorate.

- Water deposits and ISRU. The purpose would be to determine the current distribution of accessible water based on available measurements, future measurements that are planned or that could be implemented in order to better determine the distribution, and the means to access it, in order to make it a viable resource for future missions.

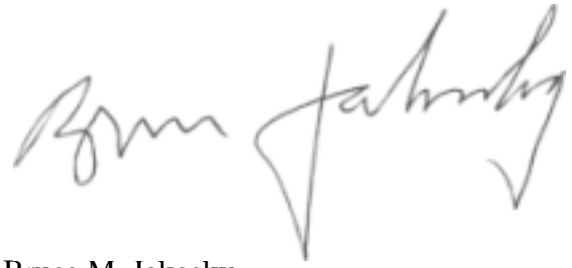
Each of these SSGs has high priority for different reasons. MEPAG probably has the capability to begin two SSGs initially, to be followed later by the other two. We are currently in the process of determining which to begin first, but we anticipate carrying all four of these out over the coming year. Input also is being solicited from the ESMD contacts to MEPAG.

Next meeting tentative dates

The next MEPAG meeting is tentatively planned for 2-3 November 2005, at or near JPL. We recognize that circumstances may require us to meet at a different date, so these dates are preliminary.

Please don't hesitate to contact me if I can provide any further details on any of the issues discussed here.

Sincerely,



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Chair, MEPAG

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