



John F. Mustard
Professor
Department of Geological Sciences

Dear Sean:

July 31, 2007

This letter reports on the MEPAG meeting of July 10, which was held in conjunction with the 7th International Conference on Mars at Caltech. The purpose of the meeting was to hear an update on the Mars program, to discuss the results of the Mars Science Orbiter (MSO) science analysis group, and follow-on planning for the MSO SDT, to discuss plans for updating the MEPAG goals document, and to discuss program planning issues. The agenda for the meeting is included at the end.

Associate Administrator Address

NASA Associate Administrator Dr. Alan Stern addressed the Mars community at 1 pm on July 10 from his office, where he was accompanied by Doug McCuiston and Jim Green. In a 10-minute telephone address that was broadcast into Beckman Auditorium at Caltech, Dr. Stern focused on the goal of Mars Sample Return (MSR) by the end of the coming decade and some of the implications for the Mars program. The Mars exploration budget, currently about half of the budget for the Planetary Science Division, is not likely to grow. To accomplish MSR by 2020, or even as soon as 2018, within that framework will likely require skipping at least one Mars launch opportunity. A commitment and focus towards MSR will require rethinking the Mars exploration program science plan, beginning as early as the 2013 opportunity. As one possibility to keep the Mars science activities moving forward, Dr. Stern is considering opening the Discovery and New Frontiers programs to Mars proposals, possibly by the time of the next Discovery round. The science community will need to pick moderate sampling goals for a sample return. Dr. Stern announced that he has requested serious consideration of adding sample caching to MSL (see more detail below), and he has also suggested this for ExoMars. Dr. Stern finished with a question: Does the Mars community want to focus and commit to MSR?

Update on the Mars Program

Michael Meyer, MEP Lead Scientist, provided an overview of the recent developments in the Mars exploration. The Mars program as a whole is producing spectacular results and exceeding operational expectations. Of concern are the MGS loss in November, the unexpected length of the MER extended missions, and cost overruns in developing missions, Phoenix and particularly MSL. Dr. Meyer did emphasize that with Dr. Stern's announcement of Mars Sample Return that we should consider how the opportunities leading to 2020 could enable, enhance, and complement the science from sample return in 2020. Along these lines, a task group, commissioned by the International Mars Exploration Working Group, will meet in September to identify how international collaboration might enable Mars Sample Return. On a different note, despite the triumphs of MEP, the President's FY'08 budget decreased the program budget by over \$50M in

'09 – '11. Furthermore, the community should be aware that the FY'09 President's budget comes out in Feb.'08.

2013 Mars Science Orbiter

A report of the analysis of the options for a 2013 orbiter was presented by Dr. Wendy Calvin, who was the chair of a MEPAG science analysis group. They identified 3 primary options, each of which has several variants based on the size of the budget. The community accepted this analysis, and congratulated the MSO-SAG on a job well done. Note that the MSO-SAG did not place these three options in priority order.

- Option A. Atmospheric science – Priorities are 1) to provide a comprehensive characterization of the chemical composition of the Martian atmosphere, with particular sensitivity for the ultra-low abundance species and 2) direct measurements of winds, to uniquely constrain and validate models of atmospheric dynamics and transport.
- Option G. Geophysics/geology – Concentrates on the exploration of the uppermost few meters of regolith and mantling materials, and topographic change detection over broad regions. A landed package would address high priority objectives such as seismic activity and structure of the crust, mantle and core, in addition to surface measurements of temperature, water vapor and dust electrification in the planetary boundary layer.
- Option P. Polar science – Emphasizes detailed examination of the mass/energy balance, precise elevation and volume of seasonal and residual volatile deposits and extending the record of global climate measurements, particularly albedo and temperature relevant to energy balance, in addition to measurement of winds that will improve models of surface-atmosphere interactions at all latitudes.

The full report and summary charts are available at

<http://mepag.jpl.nasa.gov/reports/index.html>

Michael Meyer announced that, with the thorough scientific foundation provided by MSO-SAG, a Science Definition Team would be formed to scope the possibilities and formulate the objectives for a 2013 orbiter mission. In addition, a Request For Information was solicited from the community to determine the possibility of including small lander package(s) on MSO. From review of the responses received, the costs of a landed package would be over \$100M. In light of the minimal amount of funding projected to be available for a 2013 mission, the expense of lander payload attachments, and the potential benefit of aligning the mission with MSR, it was felt that Option A would be the optimal approach to defining the science objectives of MSO.

MSL sample cache

NASA HQ has asked Ames Research Center to support the MSL mission and the center appointed Christopher McKay as the lead scientist in the design and construction of a simple sample cache. Dr. McKay relayed that the cache's purpose would be to allow a future sample-return mission to take advantage of MSL's capability to acquire a diverse set of samples. The cache would be a secondary payload and would not be allowed to levy requirements on MSL. It would provide the option of returning a previously characterized set of samples and, if returned, might form only part of the set of returned

samples. We have formed an informal science team to support the cache design. Some illustrative terrestrial analyses for which the cached samples are anticipated to be suitable, given their anticipated years-long stay on the surface without environmental control or monitoring, include light-element geochemistry (elemental, mineralogical, & isotopic), nano-scale structural and elemental analysis, and absolute age dating of rocks & minerals. The preliminary science requirements are ~10 small samples of ~5 grams, the ability to accept both powdered and small rock fragments, covered containers, and a contribution to sample-sample cross contamination similar to the level required of MSL's sample-acquisition and handling system (~5%). The point of contact for the cache science definition team is John Karcz (jkarcz@mail.arc.nasa.gov).

Revision of the MEPAG Goals Document

Dr. Jeffrey Johnson, Chair of the Goals Committee, provided a short overview of the plan for revision of the Goals Document, including current membership of the Goals Committee (presentation is available at http://mepag.jpl.nasa.gov/meeting/jul-07/Goals_Document_Revision_Process_2007.ppt). Jeff also displayed a poster each day of the conference regarding the revision process (<http://mepag.jpl.nasa.gov/meeting/jul-07/poster2.pdf>). The Goals Committee plans to prepare a draft revision to the Goals Document, which they will post on the web for community comment on or near August 20, 2007. A companion short survey will allow community members to provide short comments on the basic scientific strategies embodied in the Goals Document, the structure and priority of the scientific objectives and investigations, and how the priorities relate to the Mars Exploration Plan. Comments from this website will be received until the end of September, after which the Goals Committee and MEPAG Executive Committee will prepare a revised Goals Document. At the February 2008 MEPAG meeting, the revised document will be discussed with the community in separate sessions, chaired by the relevant representatives from each Goal. The completed revision of the Goals Document will be released at the Lunar and Planetary Science Conference in March, 2008. Jeff emphasized in his presentation that the schedule provides **three main opportunities for the community to provide input to this process**: (1) at the 7th Mars Conference; (2) via the web during the period August 20—September 28; and (3) during the February 2008 MEPAG meeting.

Discussion

The objective of returning samples from Mars represents an exciting direction for the Mars Exploration Program, and one that has been advocated in any number of science strategies for many years. The Mars community as represented by MEPAG has been energized by Alan Stern's bold announcement and direction. There is no doubt that sample return, if carried out correctly, will revolutionize our understanding of Mars.

The main elements of the MEPAG discussion focused around how to best implement an MSR launch by 2020 or earlier, what science will be done and not done as a consequence of the significant effort MSR will require, and affordability of the overall program. Included in this discussion was the possible significance of caching samples with MSL as well as the possible impact of the cache on MSL's ability to meet its own critically important science objectives. In the discussion with Dr. Stern, he responded in the

affirmative to a question about whether input from the science community was needed on definition of the samples to be collected by MSR.

As with any major change in direction, the community needs time for reflection, information, and reasoned debate. Although I have heard many discussions on these topics since July 10 in my role as the MEPAG Chair, I have not yet been able to determine the community's overall perspective. I believe the community needs analysis/clarification on the following issues:

- What must be done for MSR to return samples that are scientifically selected and are in a scientifically useful state?
- What is the program architecture that will sustain the financial commitment to MSR while addressing the broader Mars science program?

For example, in the absence of budget details, there were concerns about both the overall level of Mars exploration activity prior to 2020 and the scheduling of MSR. The MEPAG participants continue to feel that a vigorous research effort involving a multi-mission program is still required to achieve our most important scientific objectives, including understanding Mars' potential for life and there is widespread belief that the program for the next decade should not devolve to just sample return. With the program's current resources, it should be possible to have a broader observation program in support of, and complementary to sample return. We need to consider carefully which of the objectives of the missions currently planned or under serious consideration, such as MSO and AFL, should still be pursued in support of and in conjunction with MSR. In addition, if the Mars program is going to elevate the priority of MSR, there are good reasons for considering scheduling it earlier than 2020, perhaps significantly so. The community fully understands that in order to conduct MSR, it will likely be necessary to "save up" money by skipping a mission opportunity.

We need to address these questions in order to generate a sustainable new program that the Mars community, NASA management, and the Mars program's sponsors can all represent with pride. Doing so in a timely manner is necessary to support any programmatic decision for MSO'13 and the missions beyond.

The Mars Exploration Program has requested MEPAG's help in analyzing some of the open issues related to the questions and opportunities posed by Dr. Stern. In response, MEPAG plans to form two new Science Analysis Groups:

1. **MSL Cache Science Analysis Group (MSLC-SAG)**. The purpose of this effort will be to analyze the potential scientific value of the samples that may be cached by MSL.
2. **Next Decade MSR Science Analysis Group (ND-SAG)**. This group will have two primary objectives. First will be to analyze the primary non-sample objectives that can be achieved in a set of missions that lead to MSR. Second will be to analyze several questions related to the kinds of samples, and their condition, necessary to answer MEPAG's high priority scientific objectives.

The next MEPAG meeting is tentatively scheduled for Feb. 20-21, 2008 in Monrovia, CA. This will be an important meeting—we encourage everyone to please mark their calendars.

Sean, please don't hesitate to contact me if you have any questions.

Best regards

A handwritten signature in black ink, appearing to read 'Jack Mustard', with a stylized, sweeping flourish at the end.

Jack Mustard

Cc: Doug McCuiston
Fuk Li
Michael Meyer
David Beaty
Rich Zurek
Debbie Calderon, for forwarding to the MEPAG mailing list