Mars Exploration Program Analysis Group
March 5, 2012

Jim Bell, Chair
Planetary Science Subcommittee
Science Advisory Council
School of Exploration
Arizona State University
Tempe, AZ 85287

Dear Dr. Bell,

This letter reports on MEPAG's meeting in Herndon, VA, February 27 and 28, 2012. MEPAG is composed primarily of research scientists, and so the attendees included 141 individuals from academia, research institutes, industry, NASA HQ (including from SMD, HEOMD and OCT), OMB, Congressional and Executive Office staff, NASA centers, ESA, other space agencies, and the press. WebEx was used to web-cast the meeting, allowing 91 additional individuals to participate. The presentation materials are being made available to the larger community through the MEPAG web site (http://mepag.jpl.nasa.gov/).

This was by no means a typical MEPAG meeting. The attendees were shocked by the severe reduction in the President's proposed budget profile for NASA's Planetary Science Division, even though its programs have dramatically advanced our understanding of the Solar System and been so compelling to the public. The deletion of support for flagship missions during the budget period, the delay of future calls for Discovery and New Frontiers PI-led (competitive) missions, and the failure to raise Research & Analysis funding were all counter to the core recommendations of the recent Decadal Survey. This severe reduction of support for Planetary Science included particularly severe reductions for the Mars Exploration Program, a program that has been scientifically productive, technically sound and highly inspiring to the public. A related impact on Mars was NASA's withdrawal from the Mars 2016 and 2018 missions with ESA thus potentially abandoning instruments that had been selected in a joint AO process and jeopardizing future collaborations to achieve what neither agency could afford to do alone. Attendees responded by reaffirming their support for a program that effectively pursues the science goals and objectives identified by MEPAG, they articulated the many adverse impacts of these proposed budget reductions to achieving the scientific goals that MEPAG has prioritized, and they debated the possible paths forward.

Presentations addressed the release of the President's proposed budget for fiscal year 2013 (FY2013), Mars in the NRC Planetary Science Decadal Survey Report, and potential joint initiatives between the Science (SMD) and Human Exploration Operations (HEO) Mission Directorates regarding Mars precursor missions. Such initiatives could also demonstrate or be enabled by technologies developed by the Office of the Chief Technologist (OCT). Considerable time was allocated for community discussion of implications and potential strategies related to the President's proposed reductions in the budget profile. Colleagues from ESA and Japan summarized their current missions and future plans. MEPAG especially appreciates that Dr. Rolf de Groot (ESA) attended and presented an update concerning ESA's recent Mars initiatives, including negotiations with ROSCOSMOS to go forward with ExoMars.

The 2013 MAVEN team provided an extensive mission update. Additional presentations addressed the ongoing landing site selection process, the completed NASA/ESA Joint Science Working Group (JSWG) report, and the Mars Exploration Program's Geodesy and Cartography Working Group. These and other developments are described in more detail in the following

paragraphs.

1. SMD Associate Administrator's presentation of the President's proposed budget and the SMD response

MEPAG greatly appreciates that Dr. John Grunsfeld, recently appointed Associate Administrator of SMD, attended the meeting to address the current budget situation and to propose strategies for sustaining the Mars Exploration Program (MEP). He participated in an extensive, frank dialog with attendees.

Dr. Grunsfeld stated that—despite the potential budget impacts described earlier—NASA remains committed to a program of Mars exploration. He reaffirmed that SMD programs will be science-driven and he invited the community to participate in a program development in which the decision-making is as open and transparent as possible. He refused to accept that there would be no future Mars missions. He stated that either the 2018 or 2020 launch opportunity must be utilized, pointing to favorable celestial mechanics and to concerns about retaining the human expertise that has been essential for the MEP. But any such mission must be affordable and reflect a coordinated effort between SMD, HEOMD, and OCT. He has tasked a Mars Program Planning Group (MPPG), to be led by Dr. Orlando Figueroa, to prepare a framework for Mars exploration that recaptures the 2018-2020 opportunities, that is traceable to MEPAG science objectives and supports future Mars Sample Return (MSR), and that exploits HEOMD-SMD synergies as well as new developments in space technology. The MPPG has been asked to develop an initial framework in March 2012 and to submit its final report by late summer of 2012; this tight schedule is driven by budget cycle considerations. The ultimate goal is to enable planetary scientists to continue Mars exploration, including as humans working on the planet's surface.

2. Planetary Science 2012 Decadal Survey

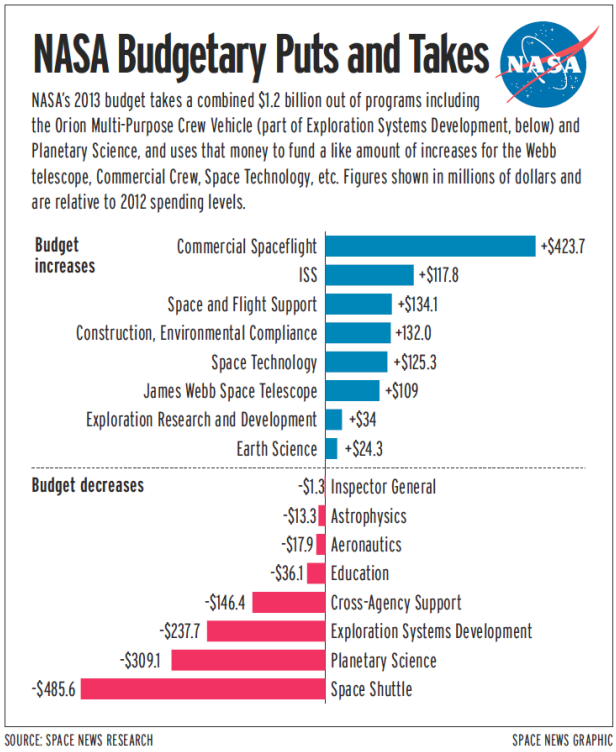
Dr. Steve Squyres, Chair of the Steering Committee for the National Research Council (NRC) Planetary Science Decadal Survey, summarized the Mars-related recommendations of the NRC Report (*Visions and Voyages for Planetary Science in the Decade 2013-2022)*. A key attribute of this report is that the planetary exploration program should achieve balance in two ways: 1) balance between mission classes (Discovery, New Frontiers and Flagships), and 2) balance between solar system destinations.

The NRC strongly endorsed the initiation of steps leading to Mars sample return (MSR). The Decadal Survey ranked the 2018 sample collection rover, the first step in sample return, as its highest priority U.S. flagship mission for the coming decade. Importantly, the actual launch dates of the second and third MSR missions that return the sample in the subsequent decade(s) could be adjusted to accommodate flagship missions to other solar system destinations or to reflect budgetary requirements. The NRC also endorsed the 2016 Trace Gas Orbiter mission in its context as a joint NASA-ESA mission. The NRC strongly advocated for international partnerships to enable and enhance this program.

The absence in the president's proposed budget of flagship missions to <u>any</u> planetary destination is exceptionally damaging. Flagship missions achieve transformational science that simply cannot be achieved by any other means. The Discovery and New Frontiers programs are incubators for innovative missions that have more rapid response times and that fill in the gaps between the flagship missions.

In the discussion that followed the presentations by Drs. Grunsfeld and Squyres, it was noted that NASA is attempting to restart the program of Mars missions with a low-cost mission in 2018/2020. It was not clear what the science goals of this mission would be and whether they would be consistent with MEPAG goals and the Decadal Survey's recommendations. Resolving

this uncertainty is critical to a Mars program and may require either the NRC to reconsider planetary and Mars options within the confines of the President's FY13 budget or to have NASA as an agency make Mars a cross-Directorate priority. SMD appears to be taking the latter approach through its effort to integrate Mars science and human exploration activities. Ironically, previous MEPAG studies on preparations for human exploration (MEPAG Goal IV) have given high priority to sample return as a necessary step, one now precluded in the next decade by the proposed budget. Furthermore, the programs in Planetary Science and Exploration Systems Development are essential for such an initiative, yet the President's budget proposes substantial reductions in both of these programs (Figure 1, graphic courtesy of SPACE NEWS).



3. Joint HEO/SMD robotic precursor missions

Dr. Michael Wargo (from HEOMD) proposed that MEPAG lead a joint study on behalf of HEOMD, OCT and SMD to define investigations, demonstrations, and priorities of common interest that could potentially be achieved in Joint Robotic Precursor Activities (JRPA) that would prepare for human missions to Mars but also optimize the benefit to Mars science. These missions would help to characterize engineering boundary conditions to improve reliability, to characterize hazards such as radiation, and to assess resources such as volatiles in the regolith. Dr. Wargo sought MEPAG's assistance to refine the understanding of the key Strategic Knowledge Gaps (SKG), namely the knowledge that must be obtained in order to execute human missions successfully and safely. A closer working relationship between HEOMD and SMD has the potential to help restore a sequence of robotic Mars missions. In response, MEPAG is currently organizing a topical Precursor Science Analysis Group (P-SAG, see below).

In the discussion that followed, members questioned how this partnership could succeed given that the only resources presently identified to support flight missions are from SMD. It was also noted that MEP had already incorporated synergistic measurements, such as the HEOMD-provided RAD radiation package now flying to Mars on the Mars Science Laboratory (MSL). Still, meeting attendees supported a joint effort to identify common measurement needs and the opportunities to meet them.

4. Mars community's response to proposed budget and to strategy proposed by SMD

MEPAG remains committed to its prioritized goals, objectives and investigations in the areas of Life, Climate, Geology/Geosciences and Preparation for Human Exploration, with Life first amongst equals in the science areas. The Mars Program architecture of orbiters, rovers, sample return and research analysis remains the most effective approach for Mars exploration. MEPAG goals and objectives are well represented in the science rationale of the current Planetary Decadal Survey. Accordingly MEPAG reaffirms its belief that, as stated in the Decadal Survey: "The analysis of carefully selected and well-documented samples from a well-characterized site will provide the highest science return on investment for understanding Mars..." Achieving sample return itself is not the goal, rather it is an essential means by which MEPAG's major science goals and objectives can be achieved.

MEPAG emphasizes that these proposed severe budget reductions would adversely impact the entire Planetary Science Division and threaten future exploration throughout the entire Solar System. With the deferral of flagship missions and delays in future New Frontiers and Discovery competitions, achievement of many of the planetary science community's highest priority goals and objectives for future exploration would be deferred, if not lost. Because a sample caching rover mission was the highest rated priority of the Decadal Survey, this loss would be particularly acute for Mars exploration. The termination of NASA's participation in ExoMars has led to closeout of MOMA and the TGO instruments (MATMOS, EMCS, MAGIE, HiSCI) and the loss of their scientific objectives that addressed important MEPAG goals. The proposed FY13 budget and run-out through FY17 (though notional) will rule out launch of a strategic Mars mission in the 2016 and possibly in the 2018 launch opportunity. Accordingly the deferral of major missions capable of addressing the highest priority science goals jeopardizes the continuation of the highly successful Mars Exploration Program.

The President's proposed budget does maintain support for the continuing development of the competitively-selected MAVEN mission in 2013 and the MSL prime mission, which address the high priority science objectives of atmospheric escape and habitability, respectively. The budget proposed for FY13-14 supports ongoing missions (ODY, MEX(US), MER-B, MRO), which continue to address important science objectives in all four MEPAG goals. Funding in later years, when MSL and MAVEN operations could be extended, remains a concern. While the budget indicates a funding decrease in Mars-related R&A programs, MEPAG is hopeful that funding for Planetary and Mars R&A can be maintained at least at their previous levels.

MEPAG supports the opening of the Discovery Mission competition to Mars missions, which provides important opportunities to address MEPAG goals by P.I.-led missions. The potential of such missions for Mars has been demonstrated by the Mars Scouts, with the success in 2008 of PHOENIX and the current progress of MAVEN toward launch in 2013. However a long-term program that addresses fundamental Mars science questions cannot be built on such missions alone but rather requires the balance of small, medium and large missions, as advocated by the Decadal Survey.

The out-year funding profile in the President's proposed budget would jeopardize the technical capability and human experience needed to safely access the surface of Mars, as it appears to rule out landing on Mars again until 2020 or later. Surface access is critically needed to address the highest priority MEPAG science goals as well as human exploration objectives.

Suggested Actions re: P-SAG

MEPAG will respond to NASA's request to analyze concepts and synergies that could emerge from an integrated program of science and human exploration objectives. MEPAG is assembling a Precursor SAG (P-SAG) to do this. This integrated program must address all four of MEPAG's goals, particularly Goal 1 which addresses the search for evidence of life.

MEPAG can also support efforts by the HQ-led team to reformulate the Mars Program through

closer integration of science and human exploration objectives, providing a path to achieve the highest priority Mars science goals, including those articulated in the Decadal Survey. An NRC-led review of the outcome of this study would be highly beneficial.

MEPAG recognizes that the recovery of the Mars program is inextricably linked to the recovery of the entire Planetary Science Program and its ability to sustain a balanced approach to the exploration of the solar system.

5. NASA and ESA operating and developmental missions. Updates were provided for the currently operating ODY, Opportunity, MEX and MRO missions. These missions are proceeding nominally and are returning exceptional scientific data. MAVEN is on track technically and also with respect to its schedule and budget. MSL (with its Curiosity Rover) is on its way to Mars.

MEPAG endorses the senior review process for continuing missions and notes that the prospect of delayed future missions makes the scientific value of these ongoing missions even more critical.

6. Landing Site Selection – MSL and subsequent missions

Drs. Matt Golombek and John Grant described plans previously developed for a joint site selection program to support future landed missions. NASA and ESA have moved forward by naming Matt Golombek, John Grant and Nicolas Mangold as co-chairs of this activity. While the 2018 Joint Rover Mission is no longer being pursued, it is imperative to make the best use of current highly capable, but aging, orbital assets to support planning for future missions, including those landing on the surface of Mars. More than a dozen additional sites were reviewed at the first workshop, which immediately followed this MEPAG meeting. The second landing site workshop is planned to occur early next year, following a call for additional sites and analysis of data to be acquired in the coming year.

Suggested Actions re: Landing Site Selection

– The MEP should continue to move aggressively on a near term program of gathering data and supporting analyses of possible future sites for landed science investigations by post-MSL missions. This program will inform early engineering decisions and take advantage of current highly capable, but aging, orbital assets.

– The landing site program should continue to include international participation, particularly between the North American and European communities.

7. Summary

MEPAG is appalled by the proposed drastic budget cuts to the NASA Planetary Science Division. Among the many dire impacts, the cuts threaten the very existence of the Mars Exploration Program, which has been one of the crown jewels of the Agency's planetary exploration. This occurs at a time when the significant discoveries of the last 15 years were about to inform and enable missions to Mars that will advance dramatically our quest of discovering life beyond the Earth, pave the way for human exploration, energize future scientists, inspire the public, and enhance U.S. prestige in space exploration.

MEPAG is also deeply concerned about the impact of these cuts on our international partnerships and collaborations. NASA's ability to honor its commitments to its international partners will be essential for achieving the most significant science goals and objectives identified by MEPAG and the international community. One small but significant indication of the need to repair relations with ESA was the absence of several Europeans who had been regular participants at previous MEPAG meetings.

This meeting was a sobering yet productive event that benefited from broad participation by NASA Headquarters and the diverse Mars community. Such communication is vital to finding a path for achieving MEPAG goals in the future. To assist this effort, the meeting focused on sustaining a program that includes currently operating spacecraft, maintaining critically important R&A and technology development programs, and recovering future missions that advance the goals and objectives of MEPAG and the international Mars community.

The MEPAG community stands ready to help further with the programs of the Planetary Sciences Division. Please feel free to contact me with suggestions or questions.

Sincerely

David J. Des Marais
Chair, MEPAG

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