

**TO: Andrew Christensen, Chair, Space Science Advisory Committee**

**FROM: Jonathan I. Lunine, Chair, Solar System Exploration Subcommittee**

**SUBJECT: Solar System Exploration Subcommittee Meeting**

The Solar System Exploration Subcommittee (SSES) of the Space Science Advisory Committee (SScAC) met July 16-18, 2003 at NASA HQ. The purpose of this memorandum is to summarize the findings of that meeting and ask SScAC to consider them and transmit its recommendations to Colleen Hartman, Director of the Solar System Exploration Division and Orlando Figueroa, Director of the Mars Exploration Program.

### **Solar System Exploration Program**

#### MESSENGER and the Discovery Program

- The SSES is deeply concerned about the status of the MESSENGER mission, the cost overruns that have broken the cap and damaged the future viability and credibility of the Discovery Program, and the potential loss of science key to planetary systems formation and that of our solar system in particular. We note that study of Mercury is a key goal of solar system exploration, as recommended by the inner planets panel of the decadal survey, because this planet is oddly metal rich yet appropriately sized to be one of the building-block “embryos” that characterized the last and longest stage of terrestrial planet formation.
- SSES recommends that the mission not be cancelled, for the following reasons:
  1. The mission does fundamental science at Mercury, in particular the study of a unique metal-rich planetary “embryo”, and the NASA program currently has no other mission to accomplish this.
  2. Problems arose late in development when 80-90% of funds were expended.
  3. To cancel then replace this key science with a later mission would be far more expensive given the maturity of MESSENGER.
- SSES applauds Headquarters appointment of an oversight board to monitor the completion of mission development. SSES further recommends HQ does the following with respect to MESSENGER:
  1. Confirm, through its oversight board, that the requested funding is based on a realistic launch schedule and payload readiness that is consistent with mission success.
  2. Provide requested phase C/D funds but collect unspent funds at launch+30 days.
  3. Deny an additional 9M requested for phase E.
- In view of the problems with MESSENGER and Deep Impact, stringent measures must be taken to bring Discovery back on track. A decision to continue MESSENGER development must not be viewed by future missions as an invitation to break the Discovery cost cap. In view of this, the community must be willing to impose penalties

on itself when missions do so, regardless of whether they are cancelled. Presently, Discovery missions that threaten to break their mission cost cap are subject to a termination review. Cost overruns in the program are accommodated by a slip in the next Announcement of Opportunity. The SSES recommends that these additional actions be implemented or considered for Discovery:

1. Implement a required minimum reserve of 25% for each proposed Discovery mission. Depending on the nature of the mission, some missions will require more than this and should be judged accordingly in the selection process.
2. When cost overruns have occurred, consider requiring that the AO for the next mission opportunity automatically have a minimum reserve of 30% (i.e., a penalty of at least 5%). This larger reserve would remain in place until missions once again come in under budget through Phase C/D.
3. Be prepared to terminate missions earlier, that is, at major review milestones (e.g., PDR, CDR), if missions appear to be only marginally within their resource envelope.
4. Strongly encourage prospective PI's to attend an intensive workshop on Discovery requirements, lessons learned, including costing approaches (e.g., fixed price versus cost plus performance fee), etc.—what might be called boot camp.
5. Develop a Discovery proposal review process that allows stronger Science-TMCO interaction, a deeper penetration by TMCO in the evaluation, and more focus on keeping science objectives in line with the scope of the Discovery program.

## JIMO

- Understanding the properties and origin of the Galilean satellites, and in particular the existence and nature of a water ocean in Europa, are key priorities of planetary exploration. The Jupiter Icy Moons Orbiter, using Project Prometheus technologies, offers a revolutionary means of answering in a single mission the key scientific questions regarding Europa while conducted detailed investigation of Ganymede and Callisto including detection of possible oceans within these worlds. This will place Europa in its planetological and astrobiological context. There is very strong interest in the scientific community in JIMO, as exemplified by the very well attended JIMO Forum held in June 2003 in Houston TX.
- SSES is concerned that the organization and pace of the Project Prometheus program are such that JIMO may not be ready for launch until well into the next decade, putting the mission well beyond the planning horizon of the NRC decadal survey that originally recommended a Europa orbiter mission as the highest priority for large-scale missions in the coming decade.
- There must be stronger interactions and more dialogue among the JIMO project, Project Prometheus, and scientific advisory committees to ensure that the scientific goals of JIMO can be met in a timely fashion by Project Prometheus, and in particular that changes in programmatic or project priorities do not permit the technology development

to drift away from fulfilling the JIMO requirements. SSES believes it is important to keep Project Prometheus focused on the goal of enabling a new generation of high value missions of scientific exploration, with JIMO the first of these missions.

### NEOO

- SSES is pleased with the substantial progress made in fulfilling the congressionally mandated survey of the solar system for asteroids on orbits potentially hazardous to the Earth.
- SSES understands that analyses indicate an 8-meter-class telescope, configured like the Large Synoptic Survey Telescope, will be less optimal than a 4-meter wide field telescope at characterizing the orbits of these objects down to of order 100 meters. Although the required wide-field does not exist on current 4-meter class telescopes, such a facility (or set of facilities) is well within the capability of university consortia and does not require a NASA effort in this area.
- However, SSES points out that access to a wide-field 8-meter-class telescope could be of extremely high value in conducting a deep survey of the trans-Neptunian region, identifying targets there for a Kuiper Belt explorer mission as recommended by the decadal survey.
- In view of the ability of the ground-based astronomical program to finish the survey of potentially hazardous objects down to of order 100 meters, SSES sees no need at the present time for a dedicated space-borne telescope for this purpose.

### International

- SSES applauds and encourages efforts to continue and enhance international cooperation in solar system exploration.
- ITAR and related regulations remain an impediment to the free and graceful conduct of international space science efforts. SSES asks NASA to continue its work with the State Department and the community to reduce the burdens associated with ITAR-based and other legal restrictions on the exchange of space science data and joint efforts in solar system exploration.

### **Mars Program**

- SSES strongly endorses the goal of precision landing on the Martian surface in order to achieve the key scientific goals of Mars exploration. Significant progress has been made in definition of a robust, affordable Entry, Descent and Landing (EDL) concept for Mars Science Laboratory (MSL) that also addresses feed-forward requirements of multiple pathways, including sample return.
- The SSES notes that the analytical laboratory currently planned for MSL is likely to have less technical maturity than recent orbiter and lander payloads selected for flight to Mars. The SSES recommends that the Mars Exploration Program (MEP) and the MSL Project

set aside appropriately robust reserves of mass, power, and cost for what will be a technically challenging, yet essential part of the MSL mission.

- The SSES agrees that the four Pathways defined by MEP provide credible guides to the next decade (2011-2020) of Mars exploration, and that they have the needed flexibility to respond to discoveries by missions currently in the MEP. However, with respect to the fourth pathway—which emphasizes the evolution of Mars -- the SSES cautions that we cannot rule out the possibility that life may have developed on Mars even without an extended period of global-scale stable (liquid) water on the surface of Mars. The lines of scientific inquiry and the ensuing potential missions need to reflect that possibility, and that a full up sample return could still potentially be a high priority under pathway 4.
- Motivated by the discussion of the Special Products Initiative within the MEP, the SSES encourages the involvement of pre-college students in all appropriate Mars mission data analysis opportunities. Existing programs (e.g. Mars Exploration Student Data Team) could be used to leverage these new opportunities.

With best regards,



- c. Dr. Colleen Hartman, Director, Solar System Exploration Division  
Dr. Orlando Figueroa, Director, Mars Exploration Program  
Dr. Jay Bergstralh, Associate Director, Solar System Exploration Division  
Dr. Jim Garvin, Lead Scientist for Mars, Office of Space Science  
Solar System Exploration Subcommittee