

REPORT
of the
Planetary Science Subcommittee
of the NASA Advisory Council Science Committee

Science Planning Conference
College Park, Maryland
3-4 May 2006

Introduction and Charge

The Planetary Science Subcommittee (PSS) of the NASA Advisory Council (NAC) Science Committee met for the first time on 3-4 May 2006, during the Science Planning Conference held in College Park, Maryland, for four of the five NAC science subcommittees. The PSS participated in plenary sessions during the morning, early afternoon, and late afternoon of 3 May, and in the early morning and over the lunch hour on 4 May. Break-out sessions of the subcommittee were held from 1:45 to 5 pm on 3 May, and from 9 am to noon and 1 to 2:30 pm on 4 May. A total of 13 of the 17 subcommittee members participated in the conference.

The charge to the subcommittee at the Science Planning Conference was threefold. The first charge was a group of administrative requests from the NAC: to become acquainted with one another, to trade contact information, to select a vice-chair, and to organize subgroups. The second charge was to provide guidance to the Planetary Science Division (PSD) of the NASA Science Mission Directorate (SMD) on the mix of its programs in government fiscal years 2006 and 2007 and beyond, particularly the health of the Research and Analysis (R&A) programs relative to flight programs and other programmatic elements. Advice was requested on three different levels: general principles that should guide resource allocations, specific programmatic recommendations, and other issues and concerns. The third charge was to provide an initial reaction to the NASA Science Plan, currently under development for delivery to the U.S. Congress by the end of the calendar year.

Administrative Matters

The PSS met its administrative assignments. A list of contact information for subcommittee members was updated and is attached. Prof. Frances Bagenal of the University of Colorado has agreed to serve as the PSS vice-chair.

Natural subgroups for PSS are those defined by the various assessment and analysis groups already in place: the Mars Exploration Program Analysis Group (MEPAG), the Outer Planets Assessment Group (OPAG), the Venus Exploration Analysis Group (VEXAG), and the Lunar Exploration Analysis Group (LEAG). These groups have been advising SMD for various lengths of time, and among the PSS members are the current chair or one of the current co-chairs of each of the four groups. These group chairs will serve as the PSS subgroup chairs, and interested members of PSS can join subgroup activities at their discretion. This arrangement will provide a natural route by which assessment and analysis group recommendations will feed in to the PSS and, through our subcommittee, to the NAC. As the need arises, additional subgroups in areas not covered by existing assessment groups (e.g., astrobiology, small solar system bodies) may be organized.

Assessment of Programmatic Mix

In assessing the appropriate mix of elements to the PSD program, and the budgets needed to support those elements, the PSS was guided by several presentations made to plenary sessions at the conference and to the PSS at its break-out sessions. An overview of this issue was given by Dr. Mary Cleave in her presentation on the morning of 3 May. At \$5.25B the 2006 SMD budget is down 4.5% from 2005, but the budget is projected at a slow rate of growth for 2007-2011

(1.5% from 2006 to 2007 and 1% per year thereafter). The PSD budget in 2006 is down 8% from 2005 but is projected to return approximately to 2005 levels in 2009-2011. Dr. Cleave's presentation was followed by one on the SMD research program and budgets given by Dr. Paul Hertz. Although budget figures differed somewhat from those given by later presenters, apparently reflecting a different "stack" of programs under the R&A heading, Dr. Hertz's figures indicate a \$50M (33%) reduction in the budget for the "standard" R&A programs in the PSD between fiscal years 2005 and 2007.

A fuller description of program elements in the PSD was presented to the PSS in its afternoon break-out session on 3 May by Dr. Andrew Dantzler. Discovery 2006 proposal Phase A selections are underway, and the Scout 2011 Announcement of Opportunity (AO) has been released. The 2006 and 2007 PSD budgets include cuts to both R&A and new technology investment; the 2007 R&A budget is \$58M less than in 2005, the result of a 15% reduction to most programs and a 50% reduction to the Astrobiology Program. Dr. Dantzler gave the following decision principles in establishing budget levels. In general, the PSD follows priorities set by the decadal survey for solar system exploration published in 2003 by the National Research Council (NRC) and supports the broad goals and directions set by the Administration. Competed mission lines (Discovery, Scout, and New Frontiers) are protected as much as possible, and launch slippage of approved missions is resisted insofar as feasible on the grounds that such delays typically result in increased total mission cost. Dr. Dantzler noted that except for R&A and technology lines, the budget consists of generally large, discrete units that cannot be trimmed to solve short-term budgetary shortfalls. Specific decisions made on the basis of these principles included postponing, as too expensive to fit within budget constraints, the Europa/Outer Planets Flagship Mission until after the 5-year period of the President's 2007 budget. By the same reasoning Mars Sample Return was postponed beyond the budget horizon. Dr. Dantzler ended his presentation with a series of straw man scenarios by which trades could be made within the given PSD budget to restore the R&A programs to 2005 levels or to permit the start of a flagship mission.

The subcommittee also heard, in plenary session, a summary by Dr. Lennard Fisk of the study report entitled "An Assessment of Balance in NASA's Science Programs" by the NRC Space Studies Board, released to the public on 4 May. Copies of the study report were distributed to PSS members.

On the basis of discussion during our break-out sessions, the PSS offers the following **guiding principles** in allocating resources within the Planetary Science Division:

- *The R&A programs in planetary science are of particular importance because, in contrast to the situation for several of the other space science disciplines, PSD does not generally support research or data analysis from flight project lines, beyond limited data analysis funds for flight science teams. The R&A programs are the source of new ideas and requirements for missions and instruments and are the principal contributor to the training of students and postdoctoral scientists, the next generation of space explorers. The R&A programs also support much of the analysis of data from ongoing and recent missions, thereby maximizing the nation's scientific return on its investment in solar system exploration.*

- *Near-term investment in technology is critical to the success of future, high-priority missions. Investments should be targeted to those technologies, such as new power and propulsion systems and new instrument concepts, which will enable or substantially enhance specific missions identified in the strategic plans for solar system exploration.*

- *The effective exploration of the solar system demands a mix of small, medium, and large missions as well as a balance of solar system targets. Small missions, supported through the Discovery and Scout Programs, foster innovative solutions to address scientific questions of recognized importance, provide frequent access to space, and stimulate technical advances in instrumentation. Medium-size missions, supported through the New Frontiers Program, permit more ambitious missions identified by the community as of high priority and high technical*

readiness. Large “flagship” missions, currently exemplified by the Cassini mission, permit the accomplishment of critical scientific objectives that cannot be met by any combination of smaller missions. A balance of mission targets among the inner planets, outer planets, and small bodies ensures a broad advance of scientific findings and maximizes the opportunities for understanding fundamental solar system processes.

Efforts by the PSS to discuss the trade-space of program mix within the PSD as exemplified by Dr. Dantzler’s straw man scenarios were strongly limited by the interpretation of NASA attorneys of regulations on conflicts of interest among members of federal advisory committees. In particular, the interpretation that subcommittee members involved with recently submitted proposals to the Discovery Program, proposals now in preparation for the Scout Program, or R&A programs targeted for large reductions must recuse themselves from discussions affecting those programs resulted in our inability to grapple with most specific scenarios for rebalancing the budget within the PSD. Such discussions could be held, according to the opinions of attorneys present at our meeting, only if conflicted subcommittee members left the room, but the affected members were so numerous and so well informed about the issues in question that the remainder of the subcommittee could not act effectively in their absence.

The PSS is nonetheless able to offer the following **specific recommendations** to the PSD regarding programmatic mix:

- *The R&A cuts in the President’s 2007 budget for the SMD Planetary Science Division undercut NASA’s return on investment in missions, threaten the viability of entire research fields, and jeopardize the continued recruitment of young space scientists and engineers. Many of the core R&A programs in the PSD have been held to flat funding levels for years, and as a result they have become extremely competitive and typically now fund only a very small number of new investigations each year. Even a 15% cut would therefore have a substantial negative impact, which would be felt disproportionately by new, young proposers, and large numbers of highly qualified young scientists may consequently be prompted to seek alternative careers. As soon as is feasible, the restoration of those cuts should be the top priority in the reallocation of funds within the PSD. The maintenance of healthy and stable R&A programs beyond 2007 should be achieved even if doing so requires the delay of a future small, medium, or large mission.*

- *The cuts to the Astrobiology Program, apparently made in the absence of advice from the scientific community, are particularly damaging. First, even if a 50% cut to an R&A program were warranted on scientific grounds, because many awards are for multiple years, the implementation of such a reduction over 1 or even 2 years means that many of the research projects that will be terminated, sharply reduced, or simply not started will include some of those most highly rated by the peer review process. Moreover, the central scientific themes of astrobiology underpin strategic plans for the exploration of Mars and the outer solar system, inform plans for the renewed exploration of the Moon, and constitute the basis for elements of the plans of the Astrophysics Division to characterize the habitability of planets around other stars. Targeting the Astrobiology Program for anomalously large cuts is sufficiently inconsistent with the rationale enunciated for a broad sweep of SMD programs that budgetary restoration for that program should receive immediate attention.*

- *The PSD should be poised to foster, through targeted data analysis or alternative programs, the thorough analysis of the large data sets to be collected by current missions as well as those in development, to ensure that the agency reaps the maximum scientific return from its flight missions. In particular, a program should be planned for the scientific analysis of data to be obtained by ongoing and future lunar missions, including the Lunar Reconnaissance Orbiter and missions by international partners.*

- *Given the history of cost growth for recent SMD missions, particularly large missions, it is important that sufficient resources be invested into concept and Phase A studies of missions*

under consideration. Such investment should be made as an essential step in establishing mission priorities.

- *Once a flight or support program has been initiated, stability and predictability of program funding are important to ensure that the most effective use is made of those funds. The PSS endorses as a decision principle that delays in approved missions, beyond those driven by technical considerations, should be avoided if at all possible, on the grounds that the increase in overall project cost and the disruption to staffing more than outweigh any short-term savings implemented as a solution to budgetary problems in a particular fiscal year.*

- *Efforts should be made to reduce management overhead in all programs.*

- *To enable the accurate tracking of support for PSD science programs, cost increases associated with the transition to full-cost accounting at NASA centers, “corporate” charges, and capital outlays (e.g., for construction of buildings) should be itemized and should not be counted as contributors to growth in science budgets. Further information on such costs should be provided to the PSS at a future meeting.*

- *The appropriate level of cost caps on competed missions should be revisited in future announcements of opportunity in an effort to balance the potential for cost savings against the provision of sufficient opportunity for innovative mission concepts. In parallel, NASA should exert agency-wide pressure to stem or even reverse recent increases in the cost of launch vehicles.*

- *The PSS endorses the principal findings and recommendations given in the NRC Space Studies Board report entitled “An Assessment of Balance in NASA’s Science Programs,” particularly those dealing with program balance, the R&A programs, the Astrobiology Program, small missions, technology investment, mission cost growth, and community involvement in the program planning process.*

Initial Assessment of NASA Science Plan

The PSS benefited from several presentations on the ongoing development of the NASA Science Plan. In a conference plenary session on 4 May, Dr. Greg Williams summarized the outline for the Science Plan and the schedule for its completion and delivery to Congress by the end of this calendar year. In a break-out session that day, Dr. Andrew Dantzler summarized the outline for the PSD contribution to the plan, its basis in the NRC solar system decadal survey and past agency roadmaps, and some of the impacts of recent budget cuts on the pace for implementing the plan in the future. His discussion was followed by presentations on two parallel roadmapping efforts. Dr. Melissa McGrath spoke on the Strategic Roadmap for Solar System Exploration, currently being updated from the 2005 roadmap, and Dr. Doug McCuiston spoke on ongoing replanning efforts for the Mars Exploration Program.

A fraction of a day is insufficient time to absorb, discuss, and provide advice on all aspects of the current planning efforts, and the PSS expects that discussions on the plan will continue at subcommittee meetings this summer and fall. Nonetheless, the subcommittee offers the following **initial reactions to the Science Plan**:

- *Strategic planning for solar system exploration should integrate the currently distinct plans for Mars and the Moon with those for other solar system bodies. Maintaining separate planning efforts runs the risk that intellectual gaps will arise between plans for different solar system targets and that technological and programmatic efforts will be unnecessarily duplicative. Such a synthesis of planning efforts does not imply integration at the programmatic level.*

- *Strategic planning for the renewed scientific exploration of the Moon should incorporate the findings and recommendations of the NRC lunar strategy now being initiated, the products of the NAC-sponsored workshop on lunar exploration to be held this fall, and the announced plans for lunar exploration by other nations. At the agency level, formal mechanisms should be established to coordinate and integrate lunar exploration planning between SMD and the*

Exploration Systems Mission Directorate (ESMD). The PSS looks forward to participating in the development of these plans.

- The plan for the next five years should include an investment in concept or Phase A studies of one or more candidate outer planet missions. In the absence of such an investment there will be too long a hiatus between major outer planet missions.
- The ratios of launch frequencies for small, medium and large missions given in the latest Solar System Exploration Roadmap are appropriate. Actual launch frequencies should be paced by budgetary considerations.
- A roadmap for new technologies should be tied to the integrated plan for solar system exploration. To the extent that technologies have cross-disciplinary applications, those interconnections should be identified in such a roadmap.

Other Issues and Concerns

The following **issues** should be addressed before the next meeting of the subcommittee:

- A solution must be sought to the legal obstacles imposed by the interpretation by NASA attorneys of federal regulations on conflicts of interest in order to permit open discussion of programs and potential budgetary trades by the full subcommittee.
- An early report from the NRC lunar exploration strategy study should be requested. Any information on that study that can be shared prior to the July meeting of the PSS would be extremely helpful.
- Improved information on the science budget within the PSD should be provided. Costs associated with corporate charges, changes in NASA center accounting procedures, and capital outlays should be itemized and tracked separately from science costs.

Agenda Items for Future Meetings

The PSS recommends that the following items be included on the subcommittee's agenda for the **July meeting**:

- A first draft of the Science Plan is currently scheduled to be distributed to the PSS in mid-June. A full discussion of that draft should be scheduled for the July meeting.
- The PSS expects to play a lead role in developing the science agenda for the fall NAC workshop on lunar exploration. Adequate discussion time at the July meeting should be set aside to accomplish that planning. An appropriate lunar scientist should be invited to address the subcommittee on scientific priorities for lunar exploration consistent with the NRC decadal strategy for solar system exploration and the new NRC lunar exploration strategy study. A summary should also be presented on current LEAG planning efforts, both to bring the PSS up to date on such activities and to illuminate mechanisms for enabling cooperation between SMD and ESMD.
- The existing assessment and analysis groups may not cover all fields of interest to the planetary science community (e.g., astrobiology, small bodies). There should be discussion at the July meeting about whether the formation of additional PSS subgroups is warranted.

At **some future meeting**, the PSS recommends the following:

- As time permits, a fuller discussion of technology needs for future missions and the costs of those technologies should be scheduled. Instrument development programs should be included in that discussion.