

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION [NASA]

PLANETARY SCIENCE SUBCOMMITTEE

April 8-9, 2010

NASA Headquarters
Washington, DC

MEETING REPORT

Dr. Ronald Greeley
Chair

Dr. Michael New
Executive Secretary

Report submitted by:
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April 23, 2010

Planetary Science Subcommittee Meeting

8-9 April 2010

NASA Headquarters
Washington, DC

Agenda: Thursday, April 8, 2010

8:00 a.m.	Welcome & Other Administrative Matters	Ron Greeley, Michael New
8:30 a.m.	Annual Ethics Briefing	Katie Spear
9:30 a.m.	Mars Exploration Program Update	Doug McCuiston
	<ol style="list-style-type: none">1. Update on ESA/NASA collaboration2. Status of MSL3. Status of ExoMars Orbiter planning4. Status of Mars 2018 planning	
10:15 a.m.	Planetary Science Division Update	Jim Green
	<ol style="list-style-type: none">1. Response to previous PSS recommendations2. Uncosted carry-over3. Update on Technology Panel4. NRC Report on Mission-Enabling Activities5. SR&T Program Briefing	
11:15 a.m.	Planetary Science Decadal Survey Status	Larry Soderblom
12:00	Lunch: <i>Science Talk</i> :	
1:00 p.m.	Analysis Group Reports	
	MEPAG	Jack Mustard
	OPAG	Bill McKinnon
	SBAG	Mark Sykes
	CAPTEM	Mini Wadhwa
	VExAG	Sanjay Limaye
	LEAG	Clive Neal
4:00 p.m.	Discussion	Ron Greeley
5:00 p.m.	Recess for the Day	

Agenda: Friday, April 9, 2010

8:00 a.m.	Welcome & Administrative Matters	Ron Greeley Michael New
8:15 a.m.	NASA Science Plan	Greg Williams
9:15 a.m.	Discussion	Ronald Greeley
10:00 a.m.	Conversation with Ed Weiler, SMD AA	
11:15 a.m.	Discussion	Ron Greeley
12:15 p.m.	Lunch	
1:15 p.m.	Selection of future meeting dates and locations Discussion and finalization of recommendations	Ron Greeley
3:00	Adjourn	

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Session of Thursday, April 8, 2010

Introduction and Welcome

Dr. Ronald Greeley, Chair

Dr. Michael New, Executive Secretary

Dr. Ronald Greeley, chair, welcomed all to the meeting; those present introduced themselves and gave the focus of their work.

Dr. Greeley urged all to recommend “science nuggets” in their area of work. These, he noted, usefully filter down to other groups. He hoped all present had reflected on their science results, as these would be passed up the line. Dr. Greeley said it helped to keep subcommittee members on track if they occasionally reviewed the group’s charge. He distributed this statement to members, with the key paragraph being:

The Planetary Science Subcommittee [PSS] is a standing committee of the NASA Advisory Council’s Science Committee supporting the advisory needs of the Administrator, the Science Mission Directorate [SMD], the Planetary Science Division, the Exploration Systems Mission Directorates [ESMD] and other NASA mission directorates as required. The scope of the Subcommittee includes all aspects of planetary science, science exploration of the Moon and Mars, the robotic exploration of the solar system, astrobiology, space- and ground-based research, technology development, planning, and training required to support these science areas. In addition to scientific research, the scope encompasses considerations of the development of near TERM enabling technologies, systems and computing and information management capabilities, as well as developments with the potential to provide long term improvements in future operational systems.

Dr. Greeley then reviewed the agenda for the current session, calling attention to one additional item. PSS members would be asked to identify ways in which the International Space Station [ISS] might be used to support planetary research. Next, Dr. Greeley polled members as to what they saw as the most pressing priorities within their disciplines.

Dr. Limaye noted that considerable time had passed since a mission had been undertaken to Venus. In consequence, he believed the community was in decline, one unlikely to be reversed until Venus had an active mission.

Dr. Wadhwa said she believed focus needed to be directed to technology development for return missions, not simply surface activities.

Dr. McKinnon said that from the “outer planets” perspectives, the primary wish was for the Flagship mission to move from planning to building; years of review and effort had been invested. Nothing else mattered as much as this undertaking.

Dr. Herzog identified as key areas sample return from Mars and from comets.

Dr. Johnson said the current and prospective R&A work would be vital to the future.

Dr. Grundy urged attention be given to comparative planetology – not all statements of purpose, he said, spoke to origin. The Division had not finished the inventory of what it knew existed.

Dr. Grant urged greater attention be paid to how long term objectives like planet return meshed with other R&A programs.

Dr. Mustard stressed international cooperation as a way to get past budget bottlenecks.

Dr. Sykes said, relative to such cooperation, the question existed of what structures were needed to encourage that cooperation to proceed.

Dr. Sumner called attention to what she saw as the erosion of foundational programs, including R&D, and the continued deterioration of the Discovery program.

Dr. Slavin commented that he doubted there had ever been a better time to be a NASA scientist. He acknowledged that concerns existed, but said this was always the case. Relative to international cooperation, he urged that its execution not shortchange U.S. scientists in the use of new technologies and instruments.

* * *

Ethics Briefing

Ms. Katie Spear

NASA Office of the General Counsel

Ms. Spear presented the annual ethics briefing. She noted that most PSS members were Special Government Employees [SGEs], who commonly work as advisors for less than 130 days in a fiscal year. Bywords for SGEs, she noted, were that a public service is a public trust; that there should be no financial conflicts of interests, and that persons should seek to avoid the appearance of impropriety. She noted that SGEs were subject to the same post-employment restrictions as regular civil servants. Proceeding in greater detail, Ms. Spears said rules regarding financial conflicts prohibit an individual from participating in any matter in which they, their spouse or a dependent child has a financial interest. She urged people facing such conflicts not only to recuse themselves, but make sure that recusal appeared in the meeting minutes.

Dr. Greeley noted that discussions of the R&A program were a sensitive area as many persons present engaged in such activities. Ms. Spears noted that in general, advisory committees dealt with matters of policy, not with contracts. However, if one were discussing whether to extend a project timeline, a given university might have an interest in the matter. In general, however, she said broad policy discussion was not subject to sanction.

Dr. Sumner observed that if one urged expanding a program, it did not follow that one's own institution would benefit from that expansion. Ms. Spears said this might be the case if a given university was regarded as the only competent to do the work.

Dr. New said the group's discussion of R&T would be structured in a way that questions of funding levels would not come up. Dr. Greeley offered an aphorism on the topic: When in doubt; step out; find out. Ms. Spears noted that no stigma was associated with recusal.

Ms. Spears next explained representation activities: an SGE was prohibited from advocating on behalf of any matter in which they were personally and substantially involved as an SGE, provided that service lasted longer than 60 days. She noted that SGEs who had completed their service were forbidden to represent to NASA on a behalf of any venture that had been under discussion, for the life of that venture. Ms. Spears explained gift rules, a gift being anything of monetary value coming from a prohibited source; that is, anyone doing or seeking to do business with NASA. This restriction does not apply to outside business interests or to personal gifts, provided the value did not exceed \$20 for any given gift or \$50 in a year from a single source.

Ms. Spears noted that SGEs were not permitted to make public use of nonpublic information obtained through committee service, nor should they give the impression that their involvement in an activity constituted a NASA endorsement. She urged anyone with questions to contact the NASA ethics office, 202-358-0394, or ethicsteam@hq.nasa.gov

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International State Station [ISS] and Planetary Research

Led by Dr. Ronald Greeley

Dr. Greeley said the question of what planetary research could be conducted in the ISS was an important one, and called for suggestions.

Dr. Herzog suggested the collection of interplanetary dust particles; Dr. Des Marais termed this impractical, as the ISS was "too messy" an environment.

Dr. Slavin said ISS could play a role in technology validation, in helping to raise future planetary instruments to TRL-6 status. As examples, he suggested particle and field instruments. One could, he said, measure an electrical field or a new mass spectrometer by placing it on the ISS to see how it operated in an environment similar to upper planetary atmospheres.

Dr. Limaye suggested that planetary telescopes could be affixed to the ISS and trained on Venus; at present, he said, perhaps too much reliance was being placed on the amateur community. Dr. Sykes said the vibration environment on ISS was not good for telescopes. Dr. Limaye clarified that he was not speaking of very high resolution equipment.

Dr. Mustard said technology development could also be done on the ISS for lower order TRL projects. This, he said, might not produce much of scientific value, but could help address the continuing problems in the early TRL development phases.

Dr. Johnson asked if sample return technologies might be included. Dr. Mustard said he believed this would have value; the technologies in question might simply “ride along” on the ISS, rather than be used by those aboard.

Dr. Calvin noted that astronauts aboard ISS might be able to create custom fixtures to hold a particular device whose testing was sought. He did not, however, wish to see a significant part of the Planetary Division budget going to “paying the rent.”

Dr. Grant asked, relative to sample return, whether such material should be looked at first aboard of the ISS. This, it was commented, had apparently not been considered for the Mars Sample Return. Dr. Sykes suggested that once samples were aboard the ISS, it might be very difficult to obtain “proof” that the samples were safe for transfer to earth.

Dr. McKinnon questioned whether ISS was a useful platform for astronomical work.

Dr. Mustard commented that the general intention of using ISS as means of launching something into orbit had been lost.

Dr. Calvin noted that years of study had been done into the design specifications of launched objects to determine to what extent there would be space for extra volume and mass to determine if additional payloads could be carried to the Moon.

Dr. Herzog suggested possible use of ISS for investigating the effects of cosmic ray exposure.

Dr. Greeley noted that previous to the ISS, he had led a planetary group considering what experiments could be done in a micro-gravity environment. The bottom line, he said, was that the ISS was not sufficiently stable to permit the experiments then foreseen. He suggested that the general topic of science use of the ISS was one the Technology Panel might wish to consider. He noted that the group would revisit the topic before adjourning.

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Mars Science Laboratory [MSL] Update

Doug McCuiston

Mars Exploration Program, Director

Mr. McCuiston reported, first, on Mars Science Laboratory [MSL] status, and, second, on partnership activities with the European Space Agency [ESA].

On MSL, Mr. McCuiston reported considerable progress; all actuators had been delivered; on avionics, the Landing Rader Transit Receive Module re-work process has been qualified; descent stage propulsion rework has been completed; cruise stage propulsion rework has been completed and delivered to the NASA Assembly, Test and Launch Operations [ATLO]; and various achievements had been made in the Thermoelectric cooler [TEC]. The fixed-focus Mass Camera [Mastcam] had been delivered to the NASA Jet Propulsion Laboratory [JPL].

Dr. Grant enquired as to the rationale for putting the zoom back on Mastcam. Mr. McCuiston said the two cameras had differing focal lengths; combined, they would provide 3-D imaging capability, which was considered very important. Dr. Grundy asked if the funds for this step were coming from the Mars program budget. Mr. McCuiston said this step had not been undertaken earlier for financial, not technical, reasons. NASA had agreed to supply the needed funds from outside the Mars program or Planetary Division budget. He characterized this step not as a mission enabler but as a mission enhancer.

Mr. McCuiston said “an enormous amount” of work had been accomplished since January 1, 2010. This included the ATLO simulation that was in progress; the successful booting of the Flight Software R6.1; the status of the 127 parts that had been classified as made from suspicious titanium. One-quarter of these had been had been reviewed with no rework required. He noted that the investigation into Multi-Mission Radioscope Thermoelectric Generator [MMRTG] continued; this may reduce operational capability during the Martian winter. Mr. McCuiston reported on the pending MSL System Integration Review – III, set for March 31-April 1, 2010; provided the conclusions of the Standing Review Board – including that major risks were well understood and were being actively addressed; and on the Remaining Challenges in Phase C/D.

Dr. Herzog asked what the phrase “negative margin” meant with reference to the landing apparatus. Mr. McCuiston said the apparatus should be able to handle stress “x”, but only currently managed “stress x-minus.” When the wheels were lowered, the aluminum structural members holding the wheels in place lacked sufficient strength not to yield somewhat on impact.

Dr. Greeley asked whether MMRTG was a “bullet” in the current plan. Mr. McCuiston said several different scenarios were under considerations for resolving the problem; cost was a factor. Dr. Greeley said he wished to hear what the overall science impact would be if reduced power conditions occurred. Mr. McCuiston said he would report on the matter in “the November timeframe.”

Nest, Mr. McCuiston next reported on the NASA-ESA Joint Initiative Management Structure; and relations with ESA generally.

Currently, he said, a joint program with ESA was being created to establish a new kind of “overhead.” He noted that while NASA tended to orient to mission lines, ESA tended to work mission-by-mission. NASA was more science-driven; ESA was more technology-driven. The joint program will be driven by a strategic long-term approach. Clear program level understanding was needed: How are missions selected? Who does what? Who undertakes management of the overall steering committee? The structure’s upper level was in place, he said: a six-member Executive Board -- half NASA; half ESA – had been meeting for the past year. Groups that engaged scientists from both continents had been established: some were working groups; others were brainstorming groups.

Dr. Greeley asked how this effort dovetailed with ESA’s “Cosmic Vision.” Mr. McCuiston said it did not. Cosmic Vision was a mandatory program, done competitively. Dr. Greeley asked how critical path issues were to be handled. Mr. McCuiston said this would be done on a project basis. The project managers and the systems engineering managers have a joint schedule whereby critical path was understood on both sides. If engineering teams prove unable to resolve schedule issues or critical path issues, these are referred to the project manager; if further resolution was needed, the matter was referred to the Executive Board.

Dr. McCuiston reported on a problem with the 2018 mission to Mars. ESA’s effort on the rover was two years ahead of NASA’s efforts; ESA has ready to go to Preliminary Design Review [PDR]; NASA did not have a basic design. That two-year disconnect had been worked on for six months; the Executive Board had resolved the matter by having NASA accelerate its activities and ESA slow theirs down. Dr. Mustard asked what science representation was engaged in the 2018 mission and with Mars Sample Return. Mr. McCuiston said he could not answer that question off-hand.

Mr. McCuiston noted that on the 2016 mission, Announcements of Opportunity [AOs] on instrumentation had been issued in January 2010. Proposals were due the week following this meeting. Selection would be a joint NASA-ESA undertaking, taking place in the U.S. He believed the 2016 mission would undergo Output Data Redundancy [ODR] by the end of 2010, with a larger review scheduled for the following year. On the 2018 mission, he said that fitting two rovers into a single landing platform presented many challenges. Considerable concept work was in progress; Level I and Level II requirements were being written. He believed the writing of requirements documents should begin soon. Mr. McCuiston expressed concern that the 2018 mission could easily be made larger than intended. No major reviews of the 2018 mission were scheduled before 2011.

Dr. Greeley commented that Mars remained an exciting program; the opportunity of joining forces with ESA was both exciting and challenging.

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Planetary Science Division Program Status

Dr. James Green, Director

NASA Planetary Science Division

Dr. James Green said he would present information on the current [FY10] division budget; President Obama’s [FY11] budget as it affected the Division; PSS recommendations, and a divisional overview.

Dr. Green noted passage of the FY10 budget, which included an \$11.3 million increase for NASA’s Lunar Landing risk reduction and \$2 million for the Near-Earth Object [NEO] program at Arecibo. At the same time, the budget directed that \$18.2 million in cuts be made by PSD. This had been accomplished by delaying the next Discovery mission; reducing R&A by \$3 million; and removing \$11.2 million from the Lunar Atmosphere and Dust Environment Explorer [LADEE] budget. He believed the cuts made were preferable to the alternatives: further reductions in R&A; delaying any mission with a scheduled 2011 launch; or delaying Mars Atmosphere and Volatile Evolution [MAVEN].

Dr. Green reported that Congress believed NASA left too much money unspent for too long; because some bills were slow to arrive, it appeared NASA had money on hand when it did not. This occurred, he said, largely because NASA was, in part, a science agency. Research funds were obligated well in advance of being spent and billed. Grants, he said, represented about five percent of NASA’s budget, but were responsible for half the unspent funds. He emphasized that he had promised NASA the Division would do better.

Dr. Sykes sought clarification of the difference between accrued and unspent. The response was that funds that had been obligated but not spent were regarded as unspent. Dr. Slavin said PSS might lose some funding unless a solution to the matter was found. Dr. Green said the key problem was that funds had been allocated for which no physical bill had been presented. Dr. Greeley said two things were on the table: first, there was an immediate need to make a suitable response to Congress; second, longer term budget problems were not going to go away; e.g. because of Continuing Resolutions, sliding funds, etc. Dr. Greeley said NASA should attempt to persuade Congress that, because it was in part a research agency, it

had operations similar to those of the National Science Foundation [NSF] and needed a similar approach to accounting. Dr. Green noted that some funds had gone unbilled for two or more years; greater diligence was required.

Dr. Green presented a chart on PSD SR&T Uncosted Policy. Dr. Green said all program officers [POs] had been requested to apply active grants management; that is, to discuss with their principal grant recipients what funds would actually be required over the next 12 months, and then provide only that much. This, he noted, might call for dialog between POs and Principal Investigators [PIs]; the latter would need to provide actual requirements for financial support.

Dr. Neal said this would increase the work pressure on PSS's "dwindling" supply of POs. Dr. Green acknowledged this as so. Dr. Green said the effort would initially be directed to major recipients of funds -- "this is the year we will make a good faith effort." Dr. Herzog noted that at his university, no money came in until it was billed. Dr. Calvin said that most major universities found it difficult to achieve financial efficiency with grant programs; often, they had small staffs and acted only when an individual PI supplied the requisite paperwork. So long as universities had positive cash flow, he noted, they were in no hurry to process the grants-related paperwork: some took six months to do so; some took eighteen months. Dr. Sykes noted that matters were further complicated by the variety of means whereby funds were transferred -- e.g. letters of credit; contacts; bills; etc. Dr. Slavin said "standard practices" varied tremendously from institution to institution.

Dr. Green was asked what actions other NASA divisions were taking. He replied that Astrophysics was taking a similar approach; Heliophysics, which had a smaller R&A program, was conducting a test approach on several programs; Earth Science, with R&A programs comparable to PSS, had for some time undertaken semi-annual funding sections, with each dispersing funds required for six months. Craig Tupper [audience member; NASA headquarters] said that accrued cost was equal to funds that had actually been spent; cost was to be the same as work actually done.

Dr. Green presented a slide on LADEE Mission Background and Key Parameters

Dr. Green said LADEE was a 100-day science mission intended to characterize the lunar exosphere and dust. It was being built at the Ames Research Center; was originally intended to support the Vision of Space Exploration and will carry three science instruments. Launch is scheduled for late 2012 or early 2013 aboard a Minotaur spacecraft. He noted that a series of delays -- including a protest filed by the commercial industry over the non-competitive award of the project to Ames -- had added to the cost of the mission. Originally set for \$184 million, it was now estimated at \$206.8 million. That figure, he noted, did not include the \$20 million needed for the laser component, which was funded separately.

Dr. Green then presented the SMD FY11 budget by division. He called attention to the pending increase for PSS, from \$1,341.3 billion in 2010 to \$1,485.8 billion in 2011. Noting the FY11 figure, Dr. Green said approval had been given to extend Cassini; the NEO program was being greatly expanded, and funds had been budgeted to begin work on the PU238 program in association with the Department of Energy [DoE]. This was contingent on DoE receiving approval of its own budget. Additionally, he said, full funding would be maintained on all upcoming missions; Advanced Stirling Radioisotope Generator [ASRG] will be developed for 2014/2015 launch readiness; funding would continue for the Europa Jupiter System Mission. He noted, as a caution, that Congress had yet to act on the President's request.

Dr. Green then presented PSS recommendations.

The first was to urge NASA to work with DoE on seeking a supply of Pu238. Dr. Grundy asked if acquisition of plutonium from Russia was being negotiated. Dr. Green said negotiations had been underway for several months; Russian plutonium was needed and his preference was to buy it sooner rather than later. The issue was not availability, but cost; the Russians were aware the U.S. currently had no other source.

Additional recommendations were:

- 2] PSS requests it be kept current on developments in the 2016 Mars mission
- 3] PSS requests it be informed if MSL development costs increase in a way that may impact non-Mars programs
- 4] PSS recommends the creation of a PSS team to evaluate all SR&T programs
- 5] PSS recommends this work group evaluate the role of Co-1/IDS/PS on long duration missions
- 6] PSS supports formation of a panel to assess technology development projects
- 7] PSS recommends the additional funds for NEO be a shared cost
- 8] PSS recommends the NAC Science Committee address the long-term funding of the Arecibo Observatory

Dr. Green presented recent administrative changes within PSS; these include multiple high level positions. The positions will be advertised soon; he believed these were very important choices. Dr. Green welcomed candidates suggested by subcommittee members.

Dr. Green described recent PSS accomplishments, including New Frontiers selections; the establishment of the Discovery AO schedule; the release of Stand Alone Missions of Opportunity Notice [SALMON] for instruments on ESA's Trace Gas Orbiter, and the release by the National Research Council [NRC] of its NEO Survey and Mitigation report.

Dr. Green reported on the NASA-ESA Bilateral. He noted that, as the existing letter of agreement was rather old, he would seek a newer one that was more specific about joint science objectives, instrument activities, and how these missions tie together over time. He noted that ESA has expressed interest in participating in the PSS scientist program; one purpose of which was to involve young people from both sides of the Atlantic.

Dr. Green next reported on NEO Status and Plans. The NEO program has been expanded from \$4 million to \$20 million; he noted that the results of the NRC study must be taken into consideration. The group had been charged by Congress with finding and tracking 90 percent of NEOs of 140 meters or more in diameter which could conceivably present a hazard to earth. The additional funds, he said, will extend collections; enhance solicitations in ROSES; support continued radar observation; and investigate ground- and space-based techniques to detect, track and characterize NEOs. Dr. Neal asked if the NEO program could fund the monitoring of impact rates on the Moon. Dr. Green said he believed something similar was being funded through LASER. Dr. Neal asked if this effort involved recording current impacts. Dr. Green said he did not know. Discussion followed on the need to solve long-term funding questions for Arecibo.

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Planetary Science Decadal Survey Update

Dr. Laurence A. Soderblom

United States Geological Survey

Vice Chairman, Planetary Science Decadal Survey

Dr. Soderblom presented the general context and purpose of the decadal surveys, which provide the primary scientific input used by NASA to lay out the planetary exploration program. The pending survey will cover 2012-2022. One important goal of the survey was that it reflects the community's consensus; therefore, extensive community input and participation was essential. He noted that this survey would be governed by a "statement of task" provided by NASA and NSF, with input from Office of Management and Budget [OMB]. He identified the following as key survey features: its intentions must fall within anticipate financial constraints; "top-line" funding increases were not appropriate; and the investigation of Moon and Mars would be integrated with the priorities for the other solar system objects. He emphasized that independent cost estimates would be obtained. Dr. Greeley said he believed independent cost estimates were important to the effort. Dr. Soderblom said the major findings and prioritized recommendations were due to be delivered by NSF and NASA by March 31, 2011.

Dr. Soderblom said the survey will assess the status of knowledge; inventory top science-related questions; assess ground-based infrastructure; consider the role of human space exploration; review program balance; prioritize New Frontiers and Flagship missions; and make recommendations for NASA-funded research activities and technology development. The study will not prioritize Discovery missions. Only missions with a formal budget start date prior to 2022 will be included.

Dr. Soderblom reported that a series of town halls had been held; further, 199 White Paper had been received by September 2009; with a total of 4,935 authors or senders. These covered subjects ranging from data archiving to how teams interrelate. All papers had been reviewed by appropriate panels and folded into panel activities.

Dr. Soderblom noted that the decadal survey proceeded from a statement of goals. Deliberation by the five panels had identified the following as highest priorities:

Inner planets: Understand the origin and diversity of terrestrial planets. [Dr. Soderblom noted that climate and climate processes are a higher priority.]

Mars: A durable set of themes linked by "follow the water" and "seeking signs of life."

Giant planets: Ground truth for planets around other stars.

Outer planets/Satellites: How did they form and evolve? What processes control these bodies? What are the processes that result in habitable environments?

Primitive Bodies: Decipher the record in primitive bodies of epochs and processes not obtainable elsewhere.

Dr. Soderblom said this decadal survey would place much greater emphasis on the technical maturity and cost feasibility of candidate missions. To this end, the panel and steering groups would include experts in engineering, project management and cost estimation. The decadal survey goal of "fiscal and technical" realism would in part be realized through the

provision of independent cost estimating by the Aerospace Corporation. Dr. Soderblom noted that 25 mission candidates had been selected for study. He provided a list of these, adding that additional studies were planned for NEO targets; reactor-based thermoelectric generator technology; Saturn Ring Observer and Comet cryogenic sample return technology. Dr. Greeley asked if the estimates provided by the Aerospace Corporation would be public knowledge. Dr. Soderblom said they would be part of the final report. He noted that inflation and the anticipated increase in launch costs would press against the number of missions that could be flown; likely, the 25 candidate missions would be reduced to eight to ten approved missions. Dr. Greeley asked if the full 25 would be independently costed. Dr. Soderblom said not; he believed 15 would be costed independently. Dr. Neal asked which these would be. Dr. Soderblom said he did not as yet know.

Dr. Limaye asked if any statement would be made about the program balance between Discovery and New Frontiers. Dr. Soderblom said he thought the key question was what funding caps were associated with mission categories. Dr. Limaye asked if the critiques of the White Papers would be available. Dr. Soderblom said they would not. Dr. Grundy observed that if New Frontiers candidate missions were looked at in detail, but Discovery missions were not, there might be some tendency to create a bias in the balance between the classes.

* * *

Lunch Break

NOTE: The Planetary Science Subcommittee halted its proceeding to hear a presentation by NASA Administrator Charles F. Bolden, Jr., televised by the NASA broadcasting system. Among other things, Administrator Bolden gave a list of what activities would be assigned to each NASA center, along with one-year and five-year funding levels associated with these activities.

Planetary Division Director Dr. Green noted how the activities outlined by Administrator Bolden tied strongly to planetary science; indeed, the community might not be large enough to handle them all. He noted that activities were being assigned to centers with particular expertise in the named area. He noted that the FY11 budget, the basis for the activities described, had yet to pass Congress. He further noted speculation that a particularly long Continuing Resolution may be put into effect.

Returning to the previous business, Dr. Greeley asked what science input was going into the robotic missions planning. Dr. Green noted that Dr. Paul Hertz was heavily involved in this activity. The question was raised whether other input would be sought. Dr. Neal said the LEAG [Lunar Exploration Activities Group] had been asked to prepare a report on the subject; release of the report was imminent.

* * *

Analysis Group Reports

Led by Dr. Ronald Greeley

Dr. Greeley asked those reporting to do the following: report the top three issues in the group; report what information may need to be conveyed to the NAC Science Committee or the NAC itself; and share some current “science nuggets.”

Small Bodies Assessment Group [SBAG]

Dr. Mark V. Sykes

Dr. Sykes said OPAG would meet in Pasadena, California, in August, and January 3-4, 2011, in Washington D.C. The principal focus will be development of the small bodies’ roadmap.

He cited the uncertainties surrounding the Discovery program as the subgroup’s top issue. The 90-day submission deadline on AOs was not nearly sufficient time to prepare a credible proposal, which takes a year or more. If an AO is delayed, then energy and time can be lost. He believed AOs should be regular, predictable and issued with a 15-month lead time, to allow for assembly of a credible proposal.

Dr. Green said he sympathized with this concern; he noted that future mission lines were vulnerable because they lack firm commitments. Alternately, he said, future lines could be kept intact at the expense of R&A. Dr. Sykes asked if that was any problem with having longer turnaround times on AOs. Dr. New said the major problem was financial: when an AO was issued, the agency was obligating X dollars that far in advance. The longer the lead team, the greater the financial uncertainty the agency may face. The 90-day period was not a legal requirement, he said; it existed to help maintain

financial flexibility. Dr. Slavin said he opposed longer lead times. At present, great resources were going into proposal writing; extending the lead time might “balloon” the costs of generating proposals. Dr. Neal said much more than 90 days was spent on a proposal. Dr. Grant said that once individuals know an AO was coming down the road, they begin scrambling.

Continuing, Dr. Sykes said NEO funding was his group’s second major issue: was the \$20 million discussed for FY11 a one-time or annual expectation? He urged broad input, some of it peer reviewed, in determining how to spend this money. He believed the characterization of NEOs should be expanded beyond hazard mitigation to include a systematic effort to understand this body of objects. He noted that while ‘fly-by’ opportunities to do this existed, these happened more as a matter of convenience than because of the science value they may obtain. The third major issue, he said, was the need to maintain capabilities for radar characterization of NEOs.

As his “nugget,” Dr. Sykes presented photographs from Hubble taken in the immediate aftermath of a collision between asteroids. He further noted that an asteroid that had recently crashed into earth contained a mix of elements that challenged notions of what asteroids were made of.

Mars Exploration Program Analysis Group [MEPAG]

Dr. John F. Mustard

Dr. Mustard noted that his group had a well-attended meeting several weeks ago; a report on its highlights had been submitted. He noted that he would soon be stepping down as the group’s leader.

As a “nugget,” Dr. Mustard called attention to the distribution on Mars of water ice, which had been identified in impact craters at the latitudes predicted. Water deposits tens of meters thick had been identified; presumably, they represented a glacier buried with time. Further, he noted detection of seasonal carbon dioxide frost, the first observational evidence for perennial water in the shallow subsurface. He noted the frost had been identified in locations other than those predicted. He believed the evidence showed the existence of water ice down to latitude of 23 degrees and within a meter of the surface.

Dr. Mustard reported that MEPAG was expanding its international activities; the group welcomed “all and every” to its meetings, but made a particular point of extending invitations to European colleagues to attend and to make presentations. He noted that an international representative had been added to the goals committee. He thought the key question was: how can a joint program produce the highest science plans?

Dr. Mustard reported on Network Science Analysis Group. Four stations, operating for a Martian year, would fully address all questions regarding the planet’s interior; two very well equipped stations could substantially achieve the task.

Dr. Mustard reported on the 2018 Mars mission. This mission will carry two rovers, to be delivered to the same site. This required a landing platform, which was somewhat restricted in its use by the unevenness of the terrain it can accommodate. Dr. McKinnon asked if there was a notional estimate of what this mission would cost. Dr. Mustard responded that the cost of MSL was known. An audience member observed that the biggest difference would be in the weight of the sky crane; a redesign of the existing crane would be required. Dr. Greeley asked if this aspect of the project had been developed for the decadal survey. Dr. Mustard replied, “Yes and no.” Dr. Greeley asked how the dual rover system was being looked at in the decadal survey. An audience member commented that the mission studies being undertaken would determine if a mission could be undertaken with reasonable risk and cost; a favorable answer did not in itself mean the mission would be done. Dr. Green commented that the Mars panel has requested a cost proposal for a maxi-rover; that study has been initiated and would be delivered soon.

Dr. Mustard commented that both rovers were to land in the same spot because the funds did not exist to send them to different places. He added that one reason NASA and ESA are collaborating is that both agency’s budgets would benefit from such collaboration.

Dr. Mustard said there had been a major rewrite of the group’s goals, as follows:

First, Goal 1 had read “to determine if life arose on Mars.” Given that the history of water on Mars was now better understood, the Goal 1 update aimed to characterize prior habitability; identify and characterize any present habitability; and understand the long term effects of Mars’ evolution on habitability and possible pre-biotic chemistry. One task, he said, was to see which, if any, Martian materials had the potential to preserve traces of life and, if such existed, to attempt to find them. Relative to Goal IV, Dr. Mustard said the objective of identifying the robotic investigations needed to prepare the way for the first human mission had been moved to the top.

Regarding issues and concerns, Dr. Mustard cited international cooperation. He believed his group had a strongly developing connection. He expressed concern that dedicated efforts were needed to ensure that the key science of the 2016 Mars mission not be compromised during its development phase. This, he said, was a reference to the EDL package which the Europeans may wish to include.

Dr. Green noted that this was a constant topic. He wanted to know what the plans were for the landed package; the

Europeans continued to maintain that the mission was primarily a demonstration of technology – they wish to demonstrate they have the ability to land something safely on Mars. For them, the primary object was to make the safe voyage; questions of instrumentation are currently secondary. Dr. Greeley asked if EDL gets out of hand, would it or would it not be abandoned in terms of the balance of the payload. Dr. Green said it would *not* get out of hand because it was a technology project. He believed things had been greatly helped by the final realization that there were three requirements: EDL capability; a rover; a drill. ESA wanted all three carried as one opportunity. But when these requirements were split between the 2016 and 2018 missions, Dr. Green said, it provided a different set of alternatives. He noted that the 2016 mission faced some physical constraints based on Martian dust storms.

Dr. Mustard said the issue was how to create a structure of cooperation with ESA that led to the creation of the best science. He noted that NASA and ESA had somewhat different structures and were not identical in terms of organizing bodies and committees. Should, he asked, more be done in exchanging people between NASA and ESA? He did not believe the groups in question had a large enough science representation from the other side. He was inclined to identify particular scientists, and then have them at the table as these things were being worked out. Dr. Mustard noted that the 2018 Mars mission and the Mars Sample Return mission were not well defined and needed greater scientific input; he did not wish project scientists to learn after the fact what the constraints would be.

Regarding issues and concerns, Dr. Mustard said the 2016 Mars mission presented challenges; MEPAG had gone to considerable effort to ensure that the compelling science objectives would not be compromised. Second, he noted that years of effort had gone into getting an Outer Planets mission; Europa has been chosen as the mission to the Jupiter system. His group strongly supported the Jupiter/Europa orbiter. He was deeply pleased that the Cassini mission was extended.

Outer Planets Assessment Group [OPAG]

Dr. William B. McKinnon

Dr. McKinnon opened by seconding the view that the present was a very exciting time to be a planetary scientist. He noted that the group's recent Washington meeting occurred during the season's second major blizzard, creating inconvenience and necessitating a revision of its schedule.

He noted that the group would be producing an instrument AO. Beyond that, he said, there wasn't enough money in the out years. He noted that the group was aware of past efforts to undertake review of supporting research and technology; he believed the group had some useful ideas on how this would relate to long duration missions. Dr. McKinnon commented that technology was of particular importance to outer planets work, due to the extreme conditions encountered and the time periods involved. Once, he said, you have done the "easy things" like fly-bys, the costs grow considerably. He believed new technology could play a major role in helping to control costs; technology was not just a capability issue but was essential to affordability. Dr. McKinnon noted that his group strongly supported the creation of a panel that crossed divisions and that aimed to create a coordinated plan for technology development. He noted that there were two types of technology – high TRL that could be used for flight; lower TRL for the out years. He believed an appropriate balance of the two was needed.

Dr. McKinnon reported on three recommendations:

First, that the group strongly supported the joint NASA-ESA mission to the Jupiter system.

Second, that the group believed plutonium 238 was crucial to future efforts to explore the outer solar system. He hoped Congress would act this year to restart the production of plutonium.

Third, that the group strongly supported creation of a central Technology Panel.

Dr. McKinnon presented a list of science highlights, including the confirmation that there were lakes on Titan; the observation of lake evolution [shrinkage] on Titan; the fact that Titan's gravity is consistent with a partially differentiated interior; the discovery of the Phoebe dust ring; the measurement of Enceladus plume composition; the resolution of the Iapetus hemispheric albedo dichotomy mystery; and the first ever views of the three-dimensional ring structure of Saturn.

* * *

Curation and Analysis Planning Team for Extraterrestrial Materials [CAPTEM]

Dr. Meenahshi 'Mini' Wadhwa

Dr. Wadhwa noted that her group meets semiannually; she outlined its organization and five subcommittees, with their heads. She noted that all meetings were open to the community

Dr. Wadhwa reported that since December 2009, 31 requests had been received for lunar, stardust, genesis or

cosmic dust allocations; 21 had been approved. She said Cosmic Dust Lab was closed until June 2010.

Describing current activities, Dr. Wadhwa reported:

First, completion of an independent review of the status of stardust samples of Comet Wild 2, returned in January 2006. She believed the community been served by the cataloging activities; the report is anticipated in May 2010.

Second, prioritization of lunar samples requested for engineering/resource utilization studies in anticipation of future lunar exploration had been completed.

Third, production of appropriate lunar simulants for future studies had been undertaken; a working group with LEAG is being created.

Dr. Wadhwa gave two samples of ISRU [In Situ Resource Utilization]/Engg studies: first, initiating dialog with ESMD to provide guidance in prioritization of ISRU/Engg studies using lunar samples; second, evaluating production status of lunar stimulants for use in future studies.

Dr. Wadhwa identified new initiatives, including providing input to the Technology Panel on issues related to sample return; undertaking curation facility site reviews -- including an update of long-term facilities and maintenance plan; developing sample curation, handling and allocation protocols for the anticipated Hayabusa sample [NASA is slated to receive ten percent of this sample]; and giving consideration to upper stratospheric timed collections.

Dr. Wadhwa identified three primary concerns:

First, technology development for future sample returns activities;

Second, tracking the health and future of PSS R&A programs; and

Third, establishing a relationship with ESMD to leverage future exploration plans for furthering planetary science goals

Dr. Wadhwa identified as “science nuggets”:

High-precision isotope analysis indicates homogenous distribution of [superscript] ^{26}Al in the early solar system;

Variations in U isotopes in refractory inclusions had implications on the age of the solar system;

And, geochemical modeling of solar nebula chemistry combined with planetary accretion simulations suggested the composition of “terrestrial” planets in extrasolar systems.

Venus Exploration Analysis Group [VExAG]

Dr. Sanjay Limaye

Dr. Limaye noted recent activities, including various White Papers, meetings and conferences. He noted there was no scheduled U.S. mission to Venus. Venus Express, he said, continued to operate normally and had been approved for extended operations through 2012. He hoped to change its orbit from 24 hours to 12 hours to conserve fuel. He mentioned that the Japanese [JAXA] Venus Climate Orbiter was awaiting launch. Dr. Green noted that the U.S. had scientists collaborating with JAXA on this mission.

Dr. Limaye described future international efforts related to Venus, including the European Venus Explorer [a balloon mission undergoing preliminary studies] and Venera D, a Russian mission tentatively scheduled for 2016 launch. He reported contacts with Israel to encourage interest in Venus as a potential target; the Israelis, he said, had shown interest in Mars.

Dr. Limaye detailed what he saw as the low level of interest in Venus; for example, no Venus candidate had been selected for a Discovery project. Dr. Limaye said his primary concern was that the Venus community might become extinct; it was difficult to attract graduate students and post-doctoral fellows when no mission pended. Dr. Green noted that the JAXA Venus mission has a major science component; the resulting data was to go into the system. Dr. Sykes said that while additional data on Venus was welcome, that in and of itself did not “expand the pie.” He agreed that if a field’s resources remained static, attracting new students was difficult. Dr. Greeley asked what lessons could be learned from the lunar and Mercury communities, which experienced similar “lean” times. Dr. Green said that in Friday’s session he would present information on what funds were being directed to Venus. Dr. Sykes noted that people who had been doing Mars work had expanded their skills so they could move to the lunar field when greater opportunities appeared there; something similar might happen to the Venus community. Dr. Limaye noted various reasons for pursuing work on Venus: the planet was an extreme case of global warming; it was the planet most similar to earth in many climate processes; etc. He added, as an additional constraint, that it was becoming difficult to find application reviewers with expertise in Venus.

Regarding the “science nugget,” Dr. Limaye presented a slide suggesting recent volcanic activity on Venus. He noted that Magellan had discovered hotspots on Venus; the “bumps” on the planet’s surface were suggestive of rising lava. His group had reviewed three hotspots; at least two of them were much higher than adjacent terrain. He believed this volcanic activity might be as recent as 2,500 years ago. He further noted that in July 2009, a number of amateur

astronomers observed a bright spot on Venus. Processing the resulting images showed an increase in brightness of 30 percent had occurred. Venus, he said, could be volcanically active in the present. This, he added, went to the question of monitoring the planet; at present, reliance was placed on amateurs. Dr. New asked if any formal organization of amateurs existed. Dr. Limaye said it did; he was on its board of directors. Dr. New suggested exploring how NASA could facilitate amateur activity on Venus. Dr. Johnson expressed reservations about the term “hotspots,” as perhaps implying too much.

Lunar Exploration Advisory Group [LEAG]

Dr. Clive R. Neal

Dr. Neal noted that the LEAG Town Hall had been held; its annual meeting was set for September 14-16, 2010 in Washington D.C. Dr. Neal noted that Dr. Charles Shearer would become LEAG chair as of October 1, 2010.

Dr. Neal said the FY11 budget included much that involved the Moon. This could include quantifying the polar and non-polar resources; developing technologies to support sustainability for a lunar return; undertaking sample returns from the Moon, and others.

The group’s top issue, Dr. Neal said, was that status of the lunar exploration roadmap. This had been completed and passed up the chain of command last year, but had not been acted upon. Dr. Neal said it appeared to be in some kind of limbo. Dr. Greeley commented that, having seen the roadmap himself, he regarded it as a very thorough job. The roadmap, he added, contained a great deal, but with appropriate prioritization. Dr. Greeley said clarification of the roadmap’s status was needed.

LEAG’s second issue, Dr. Neal said, concerned the timing of the next call for the NASA Lunar Science Institute proposals. Dr. Green said several choices existed: the group could move forward independently, or it could coordinate with ESMD. He noted that different groups were being brought together; his preference was to continue working with them to define jointly what would be done next and to obtain funding support from all groups. That could permit the next step to be a significant enhancement.

LEAG’s third issue, Dr. Neal said, was the Lunar Quest mission line. The subcommittee would be receiving a White Paper on this subject.

LEAG, he added, had been engaged in cataloging technologies at various TRL levels and providing that information to the community in generic form so that whenever someone considered a mission, they could readily determine what technologies exist and at what stage of refinement.

Dr. Neal stated that everyone was pleased by the “bump” in the lunar FY11 budget.

Regarding “science nuggets,” Dr. Neal reported that water existed on the lunar surface, and not only in permanently shadowed regions. He noted that the lunar samples collected 40 years ago were still being used to make fresh discoveries. He called attention to flow textures and impact melts on the Moon; these came from Lunar Reconnaissance Orbiter [LROC], which, he said, provided phenomenal resolution. Dr. Neal added that new lunar lithologies have been noted; these were not represented in the lunar samples. A paper on the subject was under review. Dr. Wadhwa said her group was considering making available lunar samples sealed forty years ago; they have been stored in a vacuum since collection. Dr. Greeley asked if proposals were being received in this area. Dr. Herzog said an announcement would be released soon.

Dr. Greeley noted a change to the Friday agenda: Dr. Weiler would speak at 11 a.m.

Dr. Greeley listed the subcommittee’s “homework” for the evening. First, it should consider how the ISS might be used to further planetary science. Second, those who had given reports should rephrase their information in the form of a recommendation, and specify to whom this recommendation should be delivered. Third, calling attention to the Congressional mandate that NASA act in costing issues, Dr. Greeley termed this an immediate concern that must be addressed by headquarters.

Dr. Greeley asked whether a recommendation should be made to the NAC urging it to promote Congressional understanding that NASA, in its science and research activities, was similar to the NSF and should be treated accordingly. Dr. Sykes commented that NASA was viewed as a mission agency as opposed to a science research agency. He was curious who had made this determination. Dr. Green said he did not know. Dr. Grant asked if some distinction could be made between mission funding and R&D funding.

Dr. Greeley’s fourth homework assignment was that subcommittee members would on Friday need to comment on the Science Plan. He urged members who had commented on the plan’s front section to review the current draft to ascertain if their comments had been adequately addressed.

The session of Thursday, April 9, adjourned at 5 p.m.

* * *

Session of Friday, April 9, 2010

The meeting convened at 8 a.m.

Dr. Greeley, Chair, noted the review of the Science Plan was the principal agenda item. Subcommittee members had received the “upfront” earlier; more recently, the section on planetary science had been delivered. The day’s other agenda items were discussion on how to approach the R&A study and discussion of planetary science possibilities that related to the ISS.

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NASA Science Mission Directorate [SMD] Science Plan

Greg Williams

NASA Strategic Integration Management, SMD

Mr. Williams said he managed the integrating of the Science Plan, with work done by a team from NASA headquarters and various centers. He noted that NASA published a new Strategic Plan every three years; SMD followed with a Science Plan at the same time. Mr. Williams said planning was dynamic: the current cycle included changes in Presidential administration and in budget expectations, which for planetary science were substantial. Three separate decadal surveys were in process almost simultaneously; the NRC would publish its plan prior to their completion.

Mr. Williams said the present was a “golden opportunity” to incorporate all recommendations of the past three years. While, he said, the Science Plan updated what had occurred, a great deal remained forthcoming. Therefore, he envisioned a minimalist plan – less extensive than that of three years ago – to bring the agency’s shareholders up to date. Mr. Williams said he did not know when the new National Space Policy would be forthcoming.

Mr. Williams noted that the subcommittee was principal external reviewer of the Science Plan as it related to planetary science. All comments received would be integrated into a draft 2.0 and supplied to the NAC Science Committee.

Dr. Sykes said that, relative to NEOs, the plan said work must be done to study and understand them. He said considerable work on other aspects of NEOs was being done. Describing these as separate activities, he said, invited overlap. Mr. Williams said the statement was not intended to create overlap, but to avoid it. Dr. Sykes suggested that the current statement of relevant science activities and programs merely needed to be extended to cover reconnaissance activities.

Dr. Neal said the planetary science section made little reference to SMD. He believed this document was an ideal time to record that the Division had learned a great deal about precursor missions and that it was time to leverage that knowledge. Dr. Greeley said document should draw together varied activities. Mr. Williams stated that he believed Dr. Sykes was correct. He welcomed such help, asking if there were things planetary could do to exploit emerging activities.

Mr. Williams noted inclusion of a new SMD Principle; that is: “Accountability, transparent processes, accessible results, and capture of lessons learned are essential features of the Federal science enterprise.” Mr. Williams noted that three SMD challenges – the availability of PU-238; Technology Development and Demonstration, and the National Strategy for Earth Observation – had been updated to reflect the FY11 budget.

Mr. Williams touched briefly on the question of how science results were disseminated in open journals. The issue, he said, was being worked: if journal practices became more difficult, alternatives might need to be considered or created.

Mr. Williams noted that the Science Plan was generally released as part of NASA’s budget advocacy. However, given the high uncertainty on Congressional action, the decision had been to press ahead.

Dr. Greeley asked those who had submitted comments to check that the points they raised had been adequately addressed. Dr. Johnson said a number of his comments were not included. Mr. Williams said either he had not received them or had erred; he urged they be resent. Dr. Herzog said he had assumed his comments were “considered and found wanting.” Mr. Williams said that might not be true, as he was still working on the report’s front section. Mr. Williams said he intended to send out a complete revision on April 13, 2010. The current meeting would identify concerns in the planetary section; he would proceed to incorporate those. He asked subcommittee members to respond to the April 13 version by April 30. Dr. Greeley noted the NAC Science Committee next met on April 20. Dr. Green said the Science Committee would receive the April 13 draft. Dr. Greeley suggested that Mr. Williams take the subcommittee comments from this session, respond as best he could, and then present them to the committee for its final pass.

Mr. Williams posted the proposed PSS text. He said a standard pattern was used for all science group plans. He noted the italicized statement: that NASA’s goal in the Planetary Sciences was to “Ascertain the origin and history of the solar system

and the potential for life elsewhere.”

Dr. Sumner noted that the second paragraph under “Strategy” made reference to robotic exploration as “the current modus operandi...” What, she asked, about ground-based observation, or Hubble? Dr. McKinnon commented that robotics were the key element, but not the only one. Dr. Sumner expressed concern that observational activities might be left out. Further, she noted that the prime goal statement made reference to origin and history, but not to contents. Dr. McKinnon suggested the phrase “origin and evolution.” Dr. New suggested, “Origin, evolution and present state.” Mr. Williams said he might not gain approval to change a NASA goal statement. Dr. Greeley suggested that perhaps some qualifying statement might be added.

Dr. Sykes said the word “habitable” – in the second bullet following the third paragraph – was too narrow, as it suggested the activity was all about biology.

Discussion ensued on the phrasing of the fifth paragraph sentence, “NASA is completing its initial reconnaissance of the major accessible bodies in the solar system.” Dr. Greeley said members should remember that most people receiving the document were not scientifically-trained.

Dr. McKinnon commented that when major classes of organization were defined, satellites should be kept with Mars. Further -- in the fourth bullet following the third paragraph -- he urged adding the phrase “small satellites and rings” to the existing “small bodies.”

Under the “Program” section, Planetary Science and Research, Dr. Herzog said he saw nothing that united the five bulleted items. He referenced the phrase “curation, dissemination and analysis” and asked if its use suggested this was an operation unique to this group. Further, the final bullet phrase, “Nationally-unique facilities on earth,” struck him as odd. Dr. Greeley noted that most of what was listed under “Research” was in fact the tools of research; he thought this a general problem with the document. He believed the proper structure would be: first, define the areas of research and, second, identify the tools used in that research. Dr. Green, restating Dr. Greeley’s point, said emphasis should go on the research, with the supporting structures and programs identified thereafter.

Dr. Neal said the “Lunar Quest Program” referenced the 2004 U.S. space policy; had there not been a re-issue in 2006? Mr. Williams said there two distinct documents: the 2006 document did not supplant the 2004 policy. He believed the current administration was attempting to clarify this.

Dr. Sykes noted inconsistencies in use of small and medium, with reference to New Frontiers and Discovery. Dr. Greeley noted that inconsistent usage also appeared in the front section; it was important to correct this.

Regarding the “Outer Planets” section, Dr. Johnson questioned the statement that Cassini was “nearing the end of its lifetime.” Alternate wording -- that Cassini was scheduled to end in 2017 – was suggested.

In the “Technology” section, Dr. McKinnon suggested adding the word “instrumentation” to the phrase “power, propulsion and navigation.” Second, he suggested substituting the phrase “where solar power is impractical” for the existing “where solar panels are impractical.” Further suggestions included adding a statement about samples acquisition, handling and return; and a statement calling attention to issues related to radiation and temperature extremes.

Regarding the “Missions in Development” section, Dr. Herzog said the tables used in the current draft were less interesting than the mission information used in the previous draft. He believed potential readers were most interested in what a mission would do. Mr. Williams said the tables had been drafted with the awareness that the key reviewers would be Congressional staffers. Dr. Herzog acknowledged this, but maintained that the statement of science importance should be placed first.

Dr. Limaye expressed concern about terming Juno a medium-class mission. Dr. Green said it was likely to cost \$2.4 billion by completion. Dr. Sumner noted that Juno was classed as medium-sized in the current decadal survey. Dr. Neal re-emphasized the need to clarify what was called small, medium and Flagship. Dr. New noted that at one time the distinction made was between PI-led and NASA missions; the latter were strategic. Cost was a separate matter. This clarity appeared to have been lost. Dr. Sumner asked if “strategic” was a difference in size or in concept. Dr. New said cost was not necessarily related to whether a mission was PI-led or strategic. Juno, for example, was a \$1 billion PI-led mission; PRO was a \$750 million strategic mission.

Dr. Greeley asked the group to consider how to convey this clearly. Dr. Neal said the definitions of Discovery and New Frontiers were given early in the document. If one said a mission was PI-led, one also needed to identify its financial magnitude. Mr. Williams noted that while all Flagship missions were strategic, not all strategic missions were Flagship. Dr. Greeley suggested that using dollar caps was preferable to the words small, medium and Flagship. Mr. Williams said he would determine how the terminologies affected other divisions; he agreed that consistency was needed.

Dr. Green commented that other national programs had been created through the exploration side. ESA identified Mars as a target; it was still viewed as a technology exploration project. This was similar with the part of JAXA that did exploration. What Japan wanted now, he said, was a rocket that will give them the capability to put up a rocket; he could not give them such a rocket. Some international aspects, such as ESA, were working well; others, like JAXA and Israel, were not. Dr.

Green said he could be a player at the table only if he “had some chips.” Chips meant money, which had gone to MSL. At present, there were only a few plays he could make. He noted he would soon be attending a bilateral session in China; he hoped to discuss lunar possibilities and to persuade the Chinese to grant access to their existing planetary data.

Dr. Sykes presented revised wording for the section headed “Planetary Science Research”: “Discoveries and concepts in the Research program are the genesis of scientific priorities, new mission concepts, science instruments and provides the crucial context within which mission data are interpreted. This research spans ground-based telescope observations, theoretical work, laboratory studies, field work and the continuing analysis and modeling of data from past missions.”

Dr. Greeley asked that all comments be forwarded to Mr. Williams. He added that he thought the subcommittee had done a very good job of review.

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SR&T [Supporting Research & Technology] Program Briefing

Dr. James Green

Dr. Green expressed thanks to Dr. Michael New for his efforts at making a long term assessment of grants and research award activities. He noted that an enormous amount of work had gone into compiling the statistics he was to present.

Dr. Green presented a graph of the Planetary SR&T budget, showing that the major 2005-2007 reduction had been restored.

Dr. Green presented a graph of the selection rate over time; currently, it was about one in three. He believed a consensus existed that this was a good competitive measure; the program was a healthy one. He noted that 7,516 proposals had been submitted in the past six years; 2,566 had been selected – a selection rate of 34 percent. The number of proposals received was fairly constant over time. Dr. Green then discussed selection rate v. scientific grouping. Rates ranged from 44 percent for data analysis down to 19 percent for technology proposals. The average technology proposal, he noted, was in the \$250,000 range; the average in other areas was \$150,000.

Dr. Green commented that most current money disbursed went to continuing grants. There was, he said – for a long list of reasons -- considerable variability in the amount of money available for new grants in any given year. A consequence of year-to-year variability of funds was variability of acceptance rates.

Dr. Sykes noted that the costs of technology had increased dramatically in recent years; had the total sum allocated to technology kept pace? Dr. Green said he did not know. Dr. New said the selection rate for technology proposals had varied between 15 and 27 percent from 2004 to 2008. Dr. Green noted the program did not fund proposals above the level of TRL-3 or TRL-4. With the decadal survey pending, he believed the central question was how to evolve the program to best serve the community. He suggested a “step back” be taken to consider how to ensure that upfront investments were made in those technologies which future missions would require. He said individual panels were reviewing 100+ proposals; this represented a burden on them.

Dr. Green presented a graph showing group acceptance rates since 2003. Collectively, he said, no evidence existed of a trend toward unhealthy, low selection rates. He thought the higher selection rate for data analysis proposals was appropriate. He was unhappy with the low selection rate in technology, and requested the subcommittee’s help in addressing it.

Dr. Johnson said that, anecdotally, he heard the sentiment that too many grants were being funded; some were “fluffy.” Dr. Green said he had no response to this. Dr. Sumner said some data analysis work might seem fluffy because it was fed into future missions and does not tie as strongly to core programs. Dr. Johnson said one should recognize that not all investments pay off; perhaps, he said, the payoff on data analysis work was more variable. Dr. Greeley observed that some people put forth ideas that were nonsense; peer review should weed these out. However, he preferred some mistakes were made than having some good ideas lost.

Dr. Wadhwa asked if the discussion of extending grant length had had any impact. Dr. Green said many people were writing multiple small proposals; this struck him as wrong. He had written dozens of proposals himself and knew the effort involved; proposal writing represented time taken away from pursuing science. The desire was to get the community’s time back into doing research. Some thought had been given, he said, to selecting fewer, larger dollar proposals, in an attempt to reduce the number of individual submissions. Dr. Wadhwa asked about grant durations. Dr. Green said this needed discussion. Dr. New said the vast majority of grants were for three years; there had, however, been an “uptick” in four-year awards, and a few five-year.

Dr. Sykes, commenting on “fluff,” said that at panels he knew about, the 33 percent approval average meant much good science was not funded; he added that there had never been resources to fund fluff. Dr. Green said the Division had a good competitive program; it needed to see that standards were maintained and excellent science was funded. This, he

added, always pointed in the direction of needing more money. Dr. Grundy asked what share of proposals marked up as “very good” were rejected. Dr. Green commented that NASA does not fund “good” proposals; good, he said, was “the kiss of death.” An audience member commented that sometimes proposals rated “good” overall contained parts that were excellent; in such cases, partial funding may be given.

Dr. Green then provided information on where grant funds were going: 40 “key words” had been identified; approved grants were reviewed to see which, if any, key words they contained. This, he said, allowed a view that crossed the database to show funding levels by object. This “Analysis by Proposal Key Word” divided funding between eighteen different bodies. Mars, with \$29.2 million, was by far the highest, followed by Meteorites; the Moon; Small Bodies, and Saturn system. The lowest was Non-Specific Rings, which had received \$0.2 million in funding, with progressively larger amounts going to the Neptune System, Extra-Solar Planets, Earth and Planetary Protection. Dr. New noted that if a proposal related to both Mars and Venus, half the funds were assigned to each category. Dr. Green termed this very important information. He commended Dr. New for substantial efforts in drawing it together, and praised the work of program officers, who had applied the key word approach to the successful grants. Dr. Greeley said the information was a huge step forward; Dr. Limaye termed the effort remarkable and expressed his thanks. Dr. Green noted that statistics comparing university-based and private research had been not been captured; this would be an extremely time consuming task. Dr. Sykes said the data could prompt awareness that a given discipline was shrinking.

Dr. Greeley made reference to the American Institute of Physics [AIP] study. Dr. Green said it would involve querying community members about demographics – how many graduate students entered and remained in the field; faculty retention rates; etc. The study should commence this year, and would permit comparisons with earlier studies. Dr. Greeley asked the study’s delivery date; Dr. Green said he did not know.

Dr. McKinnon suggested that use of key words be made standard in proposal submissions. Dr. Green termed this a good idea, but noted that not all proposers would do so. Ensuring compliance would fall on program officers, who, he said, were already overworked. Dr. McKinnon commented that if a particular technology appeared underfunded, one could either increase total funding or rebalance existing funds. Dr. Greene said he would not undertake any rebalancing without instructions from the community. Dr. Greeley said it would be useful to have three pieces of information: first, the planetary body involved; second, the discipline involved; and third, the research approach to be used, e.g. data analysis, physical modeling; analytical modeling, etc.

Dr. Green noted that a general review of research activities must take the NRC report into account. That report’s prime recommendation was that the program should effectively fund its goals and objectives. He hoped the subcommittee would ensure that investments made were appropriate to its strategy; this, he said, may have received insufficient attention due to understaffing. Research expenditures were \$200 million out of a Divisional budget of \$1.4 billion; they represented a significant budget share and attention needed to be directed to it being spent appropriately. Dr. Neal said he fully shared Dr. Green’s point about program managers being overworked; if one was going to have management then one was going to need managers, and it was important not to overstress them.

Dr. Green presented a slide “SR&T Review.” This recommended that PSS establish an SR&T Working Group to evaluate programs within the Division, with the intention of offering advice on priorities and on the role of Co-I/IDS/PS on long duration missions. The slide referenced the statement from the NRC Mission Enabling Report that such activities be linked to overall Agency and SMD/PSD goals. Further, he said, such review should accommodate the NRC recommendation that the Division use all available tools to examine its SR&T database to gain understanding of what was being funded.

Dr. Green, responding to a comment by Dr. Wadhwa, said the Division had no funds to direct to “hot topics.” This posed a series of questions: How important were such topics? How should they be accommodated? He noted that attention tended to focus on what the program delivered over time; he thought insufficient effort was being made to look across the program strategically. Dr. Greeley asked how this might be done. He noted, first, the advice from the NRC and, second, the data Dr. Green had presented. He identified other matters to be included, such as special research institutions, ground-based facilities and laboratories, and high-end computing. He believed matters such as advanced sensors, spacecraft systems and research instruments should be addressed in concert with the Technology Panel.

Dr. Greeley asked how things might best proceed. He noted the suggestion that an SR&T Working Group be formed of the subcommittee’s members. He noted that five candidate subcommittee members were currently awaiting formal nomination: how might they be involved in this working group? He suggested the “role” issue be treated by another group, as it was likely to be a one-shot rather than continuing activity. Therefore, he thought two separate committees were needed; he presented this suggestion for consideration.

* * *

Conversation with Dr. Edward Weiler

Associate Administrator
NASA Science Mission Directorate

The session began with brief introductions by subcommittee members.

Dr. Weiler spoke first about the recent bilateral sessions with ESA: he believed NASA's relationship with ESA has never been better; improvement in the past 18 months had been notable. He said that at the Plymouth Bilateral, two separate camps existed, one of which was presenting a non-negotiable demand. It had then appeared no shared program between Europe and the United States was possible. Dr. Weiler said he had not previously witnessed so substantial a turn toward agreement as occurred in the next six months. This was definitely needed to save the Mars program, as NASA could not undertake the Mars mission unilaterally. Dr. Greeley said several hurdles remained; Dr. Weiler said these could be resolved jointly; the 2018 project still anticipated two Mars rovers.

Dr. Green said ESA's next hurdle fell in April: if ESA remained with its down select choice, then that could take another year; if it concluded sufficient information was in hand, a decision could be announced that month. A joint AO was planned on Orbiter Processing Facility [OPF] along with a letter of agreement stating both sides were working on a 2020 mission to the Jupiter system; this work, he said, would begin with issuance of a joint AO on instrument development. Dr. Neal asked if these agreements were constrained by possible contrary decisions in the forthcoming decadal survey. Dr. Weiler said the British knew the decadal survey could turn the mission down.

Dr. Wadhwa asked about ITAR licensing requirements. Dr. Weiler said the current administration was making this a higher priority; he anticipated "better days" for ITAR, but roles and the equipment required needed definition. It was, he said, a complex situation when NASA supplied a spacecraft to be launched by someone else; however, James Web Space Telescope [JWST], which had some of NASA's most advanced technology, had been launched in such circumstances. Neal asked what shared activities might be "coming down the pike" with JAXA and India. Dr. Weiler said there was nothing of which he was aware. He said that once a well thought out architecture on Mars through 2020 existed, NASA should assemble some international group where NASA and ESA could jointly show what they were planning. He believed this might prompt JAXA and India to take on a role in the undertaking. He said the positive aspect of Mars planning was that Mars Sample Return will be the Holy Grail of the decadal. It would not, he added, be a \$2-3 billion mission; it was going to be a very expensive mission and no one country could undertake it unilaterally. He believed that Mars Sample Return was today closer to being a realistic mission than at any previous time. Dr. Green stressed the importance of NASA and ESA learning to work together. Dr. Greeley expressed concern about mission requirements being added by ESA.

Dr. Weiler commented that, separately, NASA and ESA had 70 percent of what Mars Sample Return required; the largest obstacle to cooperation was getting those at NASA and ESA centers to realize and to accept that Mars does not belong to them. That, he said, was a "tougher nut" than many of the others. He affirmed that NASA lacked the budget to undertake the program on its own. Dr. Greeley said he believed the notion that a shared NASA/ESA approach was required was being accepted; he asked if the subcommittee could be of assistance on the matter. Dr. Weiler deferred this to Dr. Green. Dr. Green said he believed some difficult problems had been worked through. He expressed his appreciation for the PSS, and its contribution to working together toward common goals. He noted that more problems would be encountered in the future; when that happened, he urged people to recall how problems had been overcome in the past. Dr. Weiler said astrophysics' main problem was that, once the decadal was completed, tough choices would be faced. He hoped PSS would stand with NASA in advocating that the highest priorities be done. Dr. Neal said the bilateral with ESA would help circumvent cultural issues; he believed whatever lessons were learned from MSL should be shared with ESA; likewise, lessons learned by ESA should be shared with NASA.

On a new subject, Dr. Weiler endorsed the decision to obtain outside estimates on proposed missions. The current decadal, he noted, included costs figures that "to be kind" were underestimated. The agency had fewer programs than three years ago, in part because it had less money. The decision that all missions must be assessed at a 70 percent confidence level was both good and bad news: the good news was that each mission had higher reserves; the bad news was that less money remained for other projects.

Dr. Neal noted that the Fisk Report ['Enabling Foundation for NASA Earth and Space Science Missions'] stated that eight percent of NASA funds went to R&A. Dr. Weiler noted that instruments and technology fall in R&A. Decisions, he said, should not be made solely by applying a cutoff line to the peer review results. This might miss something important. Reviewers should look below the line for things on which program officers should "take flyers." Fortunately, if Congress passed the new President's budget, a well-funded Technology Office will be established; this might allow many things to be undertaken, including aero-capture technology, which would benefit planetary. This was something the agency would love to do, if funds existed.

Dr. Neal suggested that synergies between SMD and ESMD be investigated. Dr. Weiler offered a hypothetical: suppose ESMD offered to carry a \$50 million instrument; what might need to be eliminated to pay for it? Dr. Neal suggested that passage of the FY11 budget would provide an opportunity to cement those synergies. Dr. Weiler commented that much remained uncertain: he did not know how EMSD would pick its projects; all he knew was they planned to spend \$3 billion on them.

Dr. Limaye asked if optimism existed regarding launch vehicles. Dr. Weiler said NASA still had Atlas and Delta, though prices kept increasing. In a “Delta 2 world” he hoped new options would exist. Ares II, he added, was nice replacement for Delta. The agency, he said, would love more capability than it presently had; a large gap existed between Atlas and a Minotaur.

Dr. Greeley asked about the prospects for a continuing budget resolution. Dr. Weiler noted that Congress would wish to adjourn after Labor Day, so members could campaign. He thought a continuing resolution was a virtual certainty: the question was – how long? A long term continuing resolution would cause great havoc for NASA. Dr. Greeley noted that some universities were concerned about cash flow under continuing resolution. Dr. Green said this problem falls on the Division’s “overworked program officers.”

Dr. Weiler said Dr. Green would be particularly assisted by having additional people to work in the science management field. He noted that at the time he left NASA headquarters in 2004, earth science and space science were split. Previously, they had had 250 civil servants; current manpower for the two was 150. Dr. Neal asked if a PSS recommendation that action to be taken to alleviate the shortage of program officers would be beneficial. Dr. Weiler had the subcommittee was an independent group and could make such recommendations as it wished.

Dr. Weiler noted that the average age in his organization was 54. He was responsible, he said, for succession planning – he was uncertain that much was accomplished if he, as a 60-year old, designated a 58-year old successor. Thirty years ago, he noted, it was common practice for a young Ph.D. to come into headquarters for several years, and then make the decision to stay or to return to academia. He noted that a large group of people who came in at that time were still with the agency. At present, it was common to bring in civil servants who were 46 or 48 years old. He could not overstate, he added, the importance of experience in the civil service; at the same time, younger people needed to be getting that experience. Dr. Grant noted that Dr. Green’s organization was moving away from Intergovernmental Personnel Act [IPA] staffing. Dr. Green said one had left; two remained, though one of these was due to leave in October. He said IPAs had not been a major part of PSS.

Dr. Sykes said he had always been a big proponent of the decadal survey; however, constraints were created if the survey was regarded as “Biblical text.” He cautioned against this. Dr. Weiler agreed; he would welcome the survey listing “approved” New Frontiers missions, with specific decisions to follow. He noted that if the survey identified one Flagship mission, then it would be the only one funded. Dr. Green noted that a review occurred at the decadal’s mid-point. At that time, he said, he wished to be free to say that because of discoveries made in the proceeding five years, some vectoring was needed. Dr. Greeley said that, given that mid-term report, the decadal survey should build in some flexibility. Dr. Sykes commented that the decadal survey did not really represent the consensus of the community, but the consensus of those committees that had provided input.

Dr. Weiler said the decadal survey provided NASA with important political cover – it was highly valuable to be able to “wave the NRC flag” to members of Congress. He said it was unrealistic to authorize a “Flagship A” if it was simultaneously intended that healthy New Frontiers, Discovery and R&A programs would be maintained. If a Flagship mission was approved, the National Academy should clarify what was of lower priority. He added that the decadal survey protected NASA from the “stray notions” of new Administrators. Responding to Dr. McKinnon, Dr. Weiler said that if Dr. Green was instructed to undertake a Flagship, while maintaining Mars work, New Frontiers, Discovery, the lunar program and R&A all at current levels, then a large planets mission could not be done even by 2020. Dr. Neal expressed concern that some communities might get disenfranchised; bilaterals, he added, were valuable to keeping the community vibrant.

* * *

Subgroup Recommendations

Dr. Greeley asked each subgroup, in turn, to present its highest ranking finding. He noted that recommendations could be made to Dr. Green; to the Science Committee of the NAC; or with the request that the Science Committee take the matter to the NAC.

Small Bodies Analysis Group [SBAG]

Dr. Mark Sykes

Dr. Sykes said his subgroup's first finding was that unpredictability and uncertainty in the Discovery program undermined its value; recognition was needed that it takes a year, not 90 days, to create a worthwhile proposal. The subgroup's recommendation was that the original program goal of regular Discovery AOs be implemented, with a response time that was realistic.

Dr. Greeley noted that Dr. Green had the previous day given reasons why longer lead times were financially unfeasible. Dr. Grundy suggested stressing the word "regular" would solve a number of problems. Dr. Neal noted that in recent years Dr. Green had gained needed budget flexibility partly through delaying an AO. Would this recommendation remove flexibility Dr. Green needed to accommodate financial issues?

Dr. Green said that he had been PI on one funded and one unfunded project. If, he said, one does not work ahead of time, a project cannot "peak" at an appropriate time. He believed knowing in advance the end date for a proposal was important. Dr. Sykes asked what downside associated with a deadline of one year following issuance of the AO. Dr. Greeley said he thought Dr. Green had provided a good response to this. Predictability in the issuance of AOs was important. He suggested identifying this as an issue, with the recommendation that the subcommittee develop a response.

Venus Exploration Analysis Group [VExAG]

Dr. Sanjay Limaye

Dr. Limaye asked Dr. Green, given the difficulty experienced in retrieving data from Venus, was it reasonable to recommend that NASA attempt to create such capacity. Dr. Green said the key element in New Frontiers and Discovery was science; Dr. Limaye's point related to infrastructure strategy. As infrastructure was generally not selected, he could see this happening only in association with something "big" that a mission of opportunity might discover. He noted that NASA did not invest enough in Venus to justify building an infrastructure there as it had on Mars. Dr. Greeley noted near-term opportunities with high-end computing capabilities; he regarded this as a natural for Venus. Dr. Green commented that the supercomputer capability at Ames was used very little by the Planetary Division, and offered a good fit for Venus.

Curation and Analysis Planning Team for Extraterrestrial Materials [CAPTEM]

Dr. Meenahshi 'Mini' Wadhwa

Dr. Wadhwa subgroup's first finding related to technology development; specifically, to the need to pay attention to its role in the future analysis of materials. She believed the matter needed a hearing above the Division level. Dr. Greeley asked if the work went beyond the Planetary Science division. Dr. Wadhwa said, potentially, it did. Dr. Greeley said it could involve the lunar committee. Dr. Neal said cryogenic sampling and curation had large implications for Mars. Dr. Greeley asked Dr. Wadhwa to draft a recommendation on the subject.

Outer Planets Assessment Group [OPAG]

Dr. William McKinnon

Dr. McKinnon subgroup's first priority was that the U.S. should resume production of plutonium. Dr. Green commented this was absolutely critical to outer planets missions. He noted that Congress was yet to pass the Department of Energy's share of the costs associated with this.

Mars Exploration Program Analysis Group [MEPAG]

Dr. David Des Marais

Dr. Des Marais noted that in terms of timeliness, the 2016 Mars Orbiter mission was ambitious; the “resource box” was highly restrained. His subgroup’s recommendation was that NASA and ESA work closely to maintain a focus on the key science objectives.

Lunar Exploration Activity Group [LEAG]

Dr. Clive Neal

Dr. Neal reiterated that the LEAG exploration roadmap had languished since being presented in July 2009. His subgroup’s recommended that the Science Committee be asked to act on this. He noted that the roadmap presented had involved two years of community work. Dr. Green speculated that the delay might reflect a “wait and see” attitude by the new administration.

Second recommendations:

Dr. Neal [LEAG] recommended that a partnership with ESMD be pursued.

Dr. Des Marais [MEPAG] recommended that, while constraints on the sky crane were noted, the 2018 Mars mission move forward with the key science priorities in mind, and that it would involve two rovers.

Dr. Wadhwa [CAPTEM] recommended that some way of leveraging future goals in curation and analysis be established.

Dr. McKinnon [OPAG] recommended that support be continued for technology development to enable future Titan missions. Dr. Greeley asked if Dr. McKinnon regarded this as of higher priority than a surface mission to Europa. Dr. McKinnon said his subgroup had steered away from Europa because of cost. Dr. Green commented that once the thickness of the ice over all of Europa was known, a rationale for returning to that site in the next decadal may exist.

Dr. Des Marais [MEPAG] recommended that, in preparing for human exploration, a standard call be made for coordination that recognized the common ground between research-related activities and the resources required for a human landing.

Dr. Neal [LEAG] suggested giving Dr. Green guidance on technology; specifically, a recommendation to the Science Committee that it promote technologies that were synergistic across the range of missions.

Dr. Green noted that the Division’s commitment of \$2 million in FY11 to the Arecibo Observatory was prompting the NSF to seek Division funds for other things.

Dr. McKinnon urged the subcommittee emphasize support for the continuing development of the technology required for the Titan mission and other possible future missions; for example, a mission to Saturn.

Dr. Greeley sought comment from other subcommittee members:

Dr. Grundy noted efforts to establish open access to peer-reviewed scientific literature. Would a recommendation in this area “stiffen the spines?” Dr. Greeley noted widespread sentiment that journals were charging excessive fees; the policy appeared to be to allow people the option of voting with their dollars. This, he added, might be something for the group to revisit. Dr. Green noted that whenever he developed a proposal, he included the planned publication schedule and associated costs in the budget. He added that he never got “dinged” for doing so. Dr. Grundy noted that if an agency required publication, it made it easier for everyone to do it. He believed the National Institutes of Health [NIH] had such a policy. Dr. Greeley suggested further discussion of this at a future meeting.

Dr. Grant suggested that efforts be made to educate Congress as to the meaning of the un-costed carryover in the NASA budget, which reflected the fact that NASA was in part a research agency.

Dr. Grant asked Dr. Green if it would be helpful if the subcommittee made a statement regarding short-staffing at the Division level. Dr. Green invited the subcommittee to do so; the staff shortage was being strongly felt. Dr. Johnson said current staffing plans were a “zero sum” in that they only returned Mr. Green to a previous staffing level. Dr. Green commented that manpower distribution was decided on the “9th floor” of headquarters. He noted that headquarters had an overall body limit. Dr. Sykes commented that at one time, he was working to get more people into headquarters; at that time, there were 100 more headquarters personnel than at present. Dr. Green said he was not seeking ten new staff, but six or above would “plug a lot of holes.” Dr. Neal commented that Dr. Green was unlikely to get anything without asking.

Dr. Green said staffing needs fell largely in the science area; with perhaps one or two more in engineering. Dr.

Greeley asked if other divisions advanced similar arguments. Dr. Greene said they did. Dr. Greeley asked what might differentiate a Planetary Science request. Dr. Green said Planetary Science and Earth Science were similar in size, yet the latter had nearly double the manpower. Planetary Science represented eight percent of NASA's budget, yet the program was managed by just 25 people out of the 1,400 headquarters' employees. Dr. Greeley said the subcommittee would adopt a recommendation on this point.

Dr. Green noted that the subcommittee, at its December 2009 meeting, had not known the Division would receive an \$18.2 million reduction. He had worked hard to find a solution that did affect program; in doing so, he believed he had applied the principles the subcommittee had provided in the past. Some recognition of this by the subcommittee would be helpful.

Dr. Greeley stated that all recommendations were due by the close of business, April 13, 2009. Each should have a short paragraph of findings; a crisp, specific recommendation; and an indication as to the appropriate level to which it should be sent.

* * *

Future Plans

Dr. Greeley said the subcommittee's next meeting was set for NASA headquarters, July 12, 2010; this was the day prior to the scheduled NAC Science Committee meeting. He noted that the Rayburn Exhibit – originally scheduled for February, but snowed out – had been rescheduled for July 15, 2010. The occasion offered the opportunity for informal contact with Congressmen and their staffers. The event was important; he said it would help greatly if subcommittee members attended. The July 12 agenda would include a report from the technical panel and the group's completion of the annual Government Performance Reporting Act [GPRA] requirements. Dr. New commented, relative to the GPRA, that Planetary Science had committed itself to a set of generic metrics; the group would assess the past year's progress. He said about 90 minutes had been required for the exercise the previous year. Dr. Greeley expressed the wish that all new members would be able to attend the July session.

Dr. Greeley noted that the next NAC Science Committee meeting was set for September 28-29, 2010. The subcommittee's next meeting could be a telecom, Monday, September 13. He asked subcommittee members to consult their schedules.

Dr. Neal noted that the next LEAG meeting would be held September 14-16 in Washington, D.C.

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ISS Research Possibilities for Planetary Science

Dr. Greeley invited suggestions on how planetary science research objectives could be achieved on the ISS.

Dr. Neal suggested that very good possibilities existed for testing environmental monitoring instruments.

Dr. Sykes said the ISS could be used to advance development of instruments, such as cameras and altimeters.

Dr. Grant suggested the ISS could be used for in-space deployment, for example, of antennas and other high risk components, including robotic arms.

Dr. Limaye suggested that small telescopes placed on the ISS could monitor Venus and Mars. Dr. Greeley expressed concern that spacecraft vibration might corrupt the results. Dr. Limaye said the images were so bright this would not be a problem.

Dr. Wadhwa suggested the ISS might prove particularly useful with organic detection systems. Much of the difficulty related to knowing how to handle a sample remotely. While the ISS was too "messy" to allow actual detection, it could be well-suited to training in the physical techniques involved. Dr. Greeley said this prompted the inevitable question: why not do this work on earth? Dr. Wadhwa said her subgroup had not identified anything that required a low gravity setting; questions on possible radiation effects might be of more interest.

Dr. Green said all suggestions would require more consideration.

Dr. Grundy commented that cryogenic returns were very difficult; if these could be done in a low gravity environment, it might eliminate the requirement that they be brought back to earth.

Dr. Herzog noted that the ISS offered long-term exposure in space; therefore, it could be a useful site for determining the effects of such exposure on equipment. Dr. Neal said this might provide information about which materials would be most suitable.

Dr. Greeley asked that recommendations reach him in writing by close of day, Tuesday, April 13, 2010.

Dr. Green said he was very happy with the meeting; a great deal of material had been covered. He wanted in particular to commend the effort of Dr. Michael New.

Dr. Neal asked to whom comments on the Science Plan draft should be sent. Dr. Greeley said to Greg Williams, with a copy to him. Dr. Greeley urged all subcommittee members to review the next iteration of the Science Plan, to make certain that their comments had been incorporated appropriately. As a closing note, Dr. Greeley said he regarded the Science Plan as a highly important document; it was important that input from the planetary group be included.

The meeting adjourned Friday, April 9, at 2:20 p.m.

Appendix A: Planetary Science Subcommittee Membership List

[As of April 6, 2010]

Ronald Greeley, Chair
Regents' Professor
School of Earth and Space Exploration
Arizona State University
Tempe, Arizona

Michael H. New, Executive Secretary
Planetary Science Division
Science Mission Directorate
NASA Headquarters
Washington, DC

James F. Bell
Professor, Department of Astronomy
Cornell University
Ithaca, New York

Tom Cravens
University of Kansas
Lawrence, Kansas

David Des Marais [Proposed New Member]
NASA Ames Research Center
Moffett Field, California

John Grant [Proposed New Member]
National Air & Space Museum
Smithsonian Institution
Washington, DC

William M. Grundy
Lowell Observatory
Flagstaff, Arizona

Gregory Herzog
Rutgers University
Piscataway, New Jersey

Jeffrey R. Johnson
United States Geological Survey
Flagstaff, Arizona

Sanjay Limaye
Space Science and Engineering Center
University of Wisconsin
Madison, Wisconsin

Planetary Science Subcommittee Membership List; continued:

William B. McKinnon
Department of Earth and Planetary Sciences
Washington University
St. Louis, Missouri

John F. Mustard
Department of Geological Sciences
Brown University
Providence, Rhode Island

Clive R. Neal
Department of Civil Engineering and Geological Sciences
University of Notre Dame
Notre Dame, Indiana

James Slavin
NASA Goddard Space Flight Center
Greenbelt, Maryland

Dawn Y. Sumner
Department of Geology
University of California
Davis, California

Mark V. Sykes [Proposed New Member]
CEO and Director
Planetary Science Institute
Tucson, Arizona

Meenakshi Wadhwa
Director
Center for Meteorite Studies
Arizona State University
Tempe, Arizona

Appendix B: Persons in Attendance

Thursday, April 8, 2010:

Linda Andruske	NASA Headquarters
Max Bernstein	NASA Headquarters
Elissa Berwick	House Committee on Science and Technology
Francesco Bordi	Aerospace Corporation
Randall Carrell	Ball Aerospace
Dom Conte	Orbital Sciences
Phil Crane	NASA Headquarters
D. Day	National Research Council
David Des Marais	NASA Ames Research Center
Lamont DiBiasi	SuRI
Walt Faulconer	Johns Hopkins Applied Physics Laboratory
T. Jens Feeley	NASA Headquarters
Barry Geldazhler	NASA Headquarters
Graham Gibbs	CSA
John Grant	Smithsonian Institution
Ron Greeley	Arizona State University
Jim Green	NASA Headquarters
Will Grundy	Lowell Observatory
Greg Herzog	Rutgers University
Jeff Johnson	United States Geological Survey
Gordon Johnston	NASA Headquarters
Anne Kinney	NASA Goddard Space Flight Center
Sanjay Limaye	University of Wisconsin
Michael McGee	Lockheed Martin
Melissa McGrath	NASA Marshall Space Flight Center
Bill McKinnon	Washington University
Scott Murchie	Johns Hopkins Applied Physics Laboratory
John Mustard	Brown University
Clive Neal	University of Notre Dame
Michael New	NASA Headquarters
Marian Norris	NASA Headquarters
Kim Reh	NASA Jet Propulsion Laboratory
Garrett Seitz	Lewis Burke Associates
Joan Salude	NASA Headquarters
Jim Slavin	NASA Goddard Space Flight Center
Larry Soderblom	United States Geological Survey
Dawn Sumner	University of California, Davis
Mark V. Sykes	Planetary Science Institute
Craig Tupper	NASA Headquarters
Richard Vondrak	NASA Goddard Space Flight Center
Dan Woods	NASA Headquarters
Richard Zurek	NASA Jet Propulsion Laboratory

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Attendees, Friday, April 9, 2010

Jan Adams	NASA
Max Bernstein	NASA Headquarters
Elissa Berwick	House Committee on Science and Technology
Francesco Bordi	Aerospace Corporation
Faye Brown	NASA
Randall Carrell	Ball Aerospace
Cassie Conley	NASA Headquarters
Walt Faulconer	Johns Hopkins Applied Physics Laboratory
T. Jens Feeley	NASA Headquarters
Chris Flaherty	NASA Headquarters
John Grant	Smithsonian Institution
Jim Green	NASA Headquarters
Will Grundy	Lowell Observatory
Greg Herzog	Rutgers University
Jeff Johnson	United States Geological Survey
Anne Kinney	NASA Goddard Space Flight Center
Sanjay Limaye	University of Wisconsin
Melissa McGrath	NASA Marshall Space Flight Center
Michael Meyer	NASA Headquarters
Bill McKinnon	Washington University
Clive Neal	University of Notre Dame
Michael New	NASA Headquarters
Marian Norris	NASA Headquarters
Kim Reh	NASA Jet Propulsion Laboratory
Stephanie Stockman	NASA Headquarters
Dawn Sumner	University of California, Davis
Greg Williams	NASA Science Mission Directorate
Dan Woods	NASA Headquarters
Richard Zurek	NASA Jet Propulsion Laboratory

APPENDIX C: Papers Presented

1. Doug McCuiston: “MSL Status Update”
2. James L. Green: “Planetary Science Division Program Status”
3. Laurence A. Soderblom: “SolarSystem 2012: Planetary Science Decadal Survey Update”
4. Jack Mustard: “MEPAG Report to the Planetary Science Subcommittee”
5. William B. McKinnon: “OPAG Report to PSS”
6. Mark V. Sykes” “Small Bodies Assessment Group: Report to Planetary Science Subcommittee”
7. Meenakshi Wadhwa: “CAPTEM Report of the Planetary Science Subcommittee”
8. Sue Smrekar & Sanjay Limaye: “VExAG Status Update”
9. Clive Neal: “LEAG Report – Planetary Sciences Subcommittee”
10. Greg Williams: “SMD Science Plan”