



HQ Responses to Findings from First SBAG Meeting

**Small Bodies Assessment Group (SBAG)
Second Formal Meeting
Boulder, CO
November 18-19, 2009**



Comments on Findings from SBAG-1

(1) There are compelling small body missions for all three classes of Solar System exploration missions: Discovery, New Frontiers and Flagship. While the Europa Jupiter System Mission has been selected as the next Flagship mission, consideration should be given to a small body mission for the following Flagship opportunity.

*[The only Flagship mission identified in the SBAG decadal survey white papers is a comet cryogenic sample return] **This does not need to be addressed.***

Comments: This is really up to the community – should be part of the decadal survey. (JG)



Comments on Findings from SBAG-1

(2) Small bodies represent ubiquitous flyby targets of opportunity for NASA planetary missions during interplanetary cruise. Assessment of serendipitous science to be gained from such flybys, and reasonable support for the associated cost of acquiring the data, should be a standard part of mission planning. In addition, NASA should create a mechanism by which PIs can propose for the funding of cruise-phase serendipitous science of small body targets.

[What is the attitude of the powers that be for requiring contingency for serendipitous flyby science - either asteroid/comet flybys or small satellite flybys for major missions?] Jim Green, Discovery, New Frontiers people?

Comments: For strategic missions – HQ decision. For PI-led missions there is no HQ policy - it's up to the PI. After selected in phase A, and in Phase B it could be a mission enhancing addition. (JG)



Comments on Findings from SBAG-1

Comments: This smacks of having HQ require missions perform flybys of opportunity. The science content of PI led missions is up to the PI ... Rather than ask HQ to reserve them a spot, the small bodies community should be actively engaging their peers to be sure small bodies science (and the associated flybys of opportunity) is part of missions. Case in point, JEO will be flying through the asteroid belt, but to my knowledge no one in the small bodies community has come forward to make the case for any asteroid flybys on the way there. I've got astrophysicists coming forward with their ideas ranging from useless to interesting, but not so much the small bodies people. (CN)



Comments on Findings from SBAG-1

(3) The planetary and astrophysics communities should collaborate to identify small body science opportunities that can be accomplished with astrophysics missions, and how these translate to requirements that are practical within the context of a given mission. These opportunities could include requirements for non-sidereal tracking and spacecraft pointing near to the Sun and the Moon, as well as modifications to the data pipeline. This needs to be done early in the overall mission lifetime to identify investments that planetary science should be making in the astrophysics missions.

[Planetary is supporting NEO discovery work with the WISE mission - how do Planetary and Astrophysics explore these opportunities, and decide the extent to which science from the other division should be supported and who pays for modifications/requisit analysis?] Jim Green? Someone from astrophysics?

Comments: It's odd. Astrophysics missions don't go anywhere – they ask us to cooperate on missions that do (EPOXI). The WISE NEO work was a modification to the data system to save the data instead of discarding it. Opportunities are explored between divisions at HQ, and when staff or the community brings it to our attention at HQ. (JG)



Comments on Findings from SBAG-1

(4) Technology development is needed to support small body missions. This includes instrumentation for remote and in situ study, sample acquisition and recovery, low-thrust propulsion systems, autonomous operations, and nuclear power sources.

[How is needed technology development determined and is there a path that can bring it to a TRL that can be flown?]

Comments: If the community thinks technology development needs to be funded, they need to get that into the decadal survey with examples of what's needed. (JG)



Comments on Findings from SBAG-1

(5) Missions to small bodies afford frequent opportunities for international collaboration and the enhancement of science return as a consequence of sharing resources. Such cooperative opportunities should be pursued. The SBAG encourages NASA to participate in the newly-forming International Primitive Bodies Exploration Working Group (IPEWG), being mindful of the different approaches to data ownership and sharing that individual countries and cultures possess. In order to craft cooperative agreements, there must be an effort in advance to identify and acknowledge differences in culture and philosophy among international partners towards mission science, data accessibility, and data ownership. This allows for maximum scientific benefit to be realized while minimizing unplanned delays and the increased cost of dealing with post-facto disagreements arising from these differences. The SBAG endorses NASA's sponsorship of the next IPEWG meeting.

[SBAG will be organizing the next IPEWG meeting] - no response needed.

Comments: SBAG should form a committee to work on IPEWG meeting arrangements. Lot's of dates to work around - see Jim's list of major upcoming events. (JG)



What's Coming Up for PSD

2010

- **May – Launch of O/OREOS**
- **June 13 - Hayabusa (JAXA) asteroid sample return**
- **July 10 – Rosetta (ESA) closest approach for Lutetia**
- **Sept – LRO transitions to Planetary Science Division**
- **Nov 4 - EPOXI encounters comet Hartley 2**
- **Late '10- Early '11 – Opportunity gets to Endurance (?)**

2011

- **Feb 14 - Stardust NExT encounters comet Tempel-1**
- **Mar 18 - MESSENGER orbit insertion at Mercury**
- **July - Dawn orbit insertion at asteroid Vesta**
- **Aug - Juno launch to Jupiter**
- **Sept - GRAIL launch to the Moon**
- **Oct - MSL launch to Mars**

2012

- **Jan-Feb – Dawn leaves Vesta starts on its journey to Ceres**
- **Aug - MSL lands on Mars**
- **Oct ? - LADEE launch to the Moon**



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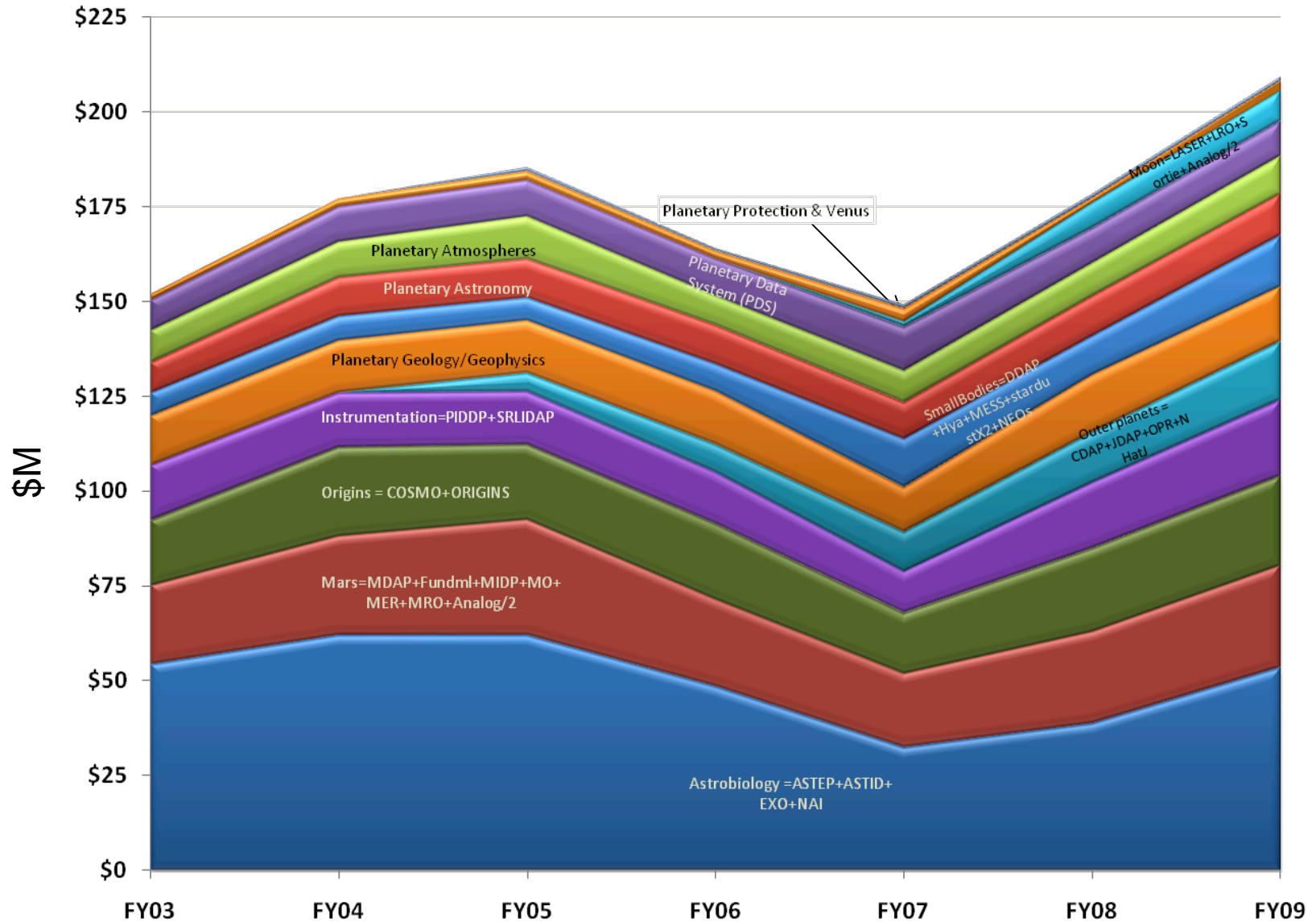
(6) NASA Research and Analysis programs are critical, mission-enabling activities for small body missions. Data analysis programs for small body mission data provide essential results that help justify those missions, as well as enable future missions. The SBAG strongly supports enhancement of the NASA R&A programs.

[There will be some discussion that bears on this] - no response needed.

Comments: We're always interested in input from SBAG, but not sure what else we can do. We're protecting R&A as much as we possibly can while always looking to spend that money more wisely. See Jim's chart – R&A is actually growing (e.g. restoring astrobiology). (JG)



Planetary R&A Budget History: FY 2003 – 2009





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(7) Small bodies are numerous and diverse. The fraction of these bodies for which we have spectroscopic and other physical information is small. This includes the changing characteristics of comets over their entire orbits. NASA should commit to providing long-term support for the acquisition of such information for as many of these bodies as possible, which likely number hundreds of thousands of objects over a period of decades. This would involve the use of small, medium and large aperture ground-based telescope facilities. This need not be a crash program, but rather something for which a baseline of ongoing activity should be established and maintained. This affords potential substantial mission cost savings by identifying more dynamically accessible targets for given science goals, and increases mission science return by creating a deeper context within which the data can be interpreted.

[There will be some discussion that bears on this] - no response needed.

Comments: There is no move afoot to reduce ground-based support of missions. (JG)



Comments on Findings from SBAG-1

(8) The SBAG endorses the concept that the large amount of observational data that will be produced by the mandated searches for the > 140m diameter Potentially Hazardous Objects (PHOs) should be easily accessible to the scientific community to encourage expanded study of these objects. This volume of data, generated with NASA support, should be archived in the NASA Planetary Data System. The PDS Small Bodies Node is responsible for ingesting and curating small body data, as well as facilitate access to these data by the scientific community. Access to small body data holdings in the PDS should be reviewed, and recommendations addressing the interfaces and tools that are made available to the community, particularly with regard to the large future volumes from PHO searches, should be identified. NASA should provide the resources necessary to implement these recommendations to provide easy identification and access to PHO and other small body data within PDS.

[How does HQ determine the level of support required for PDS to archive data and to provide tools to the community to access that data? How is the state of that assessed and needed capabilities identified?] - Mike Kelley?

Comments: The nodes are competed and peer-reviewed, and were recently put through a senior review process. We have invested in the MPC, and in the process of upgrading that (see Lindley). PDS is in the process of upgrading to the next version of their architecture (PDS-4), which should be an improvement.

(JG)

Need input from Bill Knopf, PE for PDS. (MK)



Comments on Findings from SBAG-1

(9) The SBAG reiterates the need for continued support of NASA's Deep Space Network in the future, including supporting both Ka band and X band capabilities. This capability is necessary for future, successful deep space probe operations.

[Is there a plan to support data rates from current missions? Is capability scheduled to decline or is there a plan to expand support for future missions on what timescale?]

Comments: The DSN has developed a roadmap (incl. going from S-band to Ka-band, 34-meter array). For the next SBAG meeting, invite SOMD to talk about improvements and plans. (JG)