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OF
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20 October 2014

To: The NASA Office of Inspector General
Attn: Paul K. Martin
Suite 8U71, 300 E Street SW
Washington, DC 20546-0001

Dear Mr. Martin.

I am writing this open letter with regard to the Inspector General Report No. IG-15-001 (hereafter "IG-Report") regarding the Science Mission Directorate's (SMD) Mission Extension Process that was released on 9 October of this year. In this report you highlighted the Planetary Science Division (PSD) for particular criticism because of its non-standardized approach to evaluating mission extensions. Having been part of the PSD 2012 Senior Review, and chair of the GRAIL and the PSD 2014 Senior Reviews, I feel I must respond to note some errors and misunderstandings within the IG report. It is my opinion that the proposed recommendations could have a serious deleterious impact on the effectiveness of planetary science missions.

As background, there are a couple of facts that need to be stated about PSD missions and mission extensions:

A. Every planetary science mission is different. They go to different destinations (i.e., have very different transit times), different science goals and, therefore, different prime mission timelines, and require spacecraft of widely different levels of sophistication and capability (e.g., landers vs. orbiters; those that require radioactive fuel supplies vs. those that can cope with solar power).
B. With regard to mission extensions, I would like to quote from the PSD Senior Review of 2014 "*The science value (or science per dollar) of the extended missions exceeds the science gain from any planned mission, and all have important strengths. That is, they all represent added value to the Planetary Science Division and the American taxpayer because they are essentially new missions without the development and launch costs*." Therefore, focus on new science initiatives and observations in extended mission proposals is critical.

The IG Report made four specific recommendations to improve the effectiveness of the PSD's Senior Review (SR) process:

(1) Implement a Senior Review approach that includes consideration of proposals for at least the next 4 fiscal years,
(2) Conduct consolidated reviews,
(3) Establish consistency between annual budget submissions and Senior Review extended mission budget guidelines.
(4) Develop a standardized approach for mission extension funding that clearly articulates expectations and consistently implements those expectations across all SMD Divisions.

I would like to address each of these in turn, bringing my experience in the SR process and a non-NASA perspective in the evaluation of these recommendations.

Recommendation 1: The 2005 NASA Authorization Act requires an Extended Mission proposal at the end of the prime mission (if appropriate to the mission) and subsequent reviews every 2 years. Assuming that the IG-Report does not supercede existing law, the recommendation of the IG-Report for "funding and program guidance for at least

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the next 4 years" would still have to be contingent on an extended mission review every 2 years. In that case, it is difficult to see how such a requirement would improve on the existing approach, and may actually result in a degradation of the quality and innovation of the extended mission activities. The current approach follows the letter and intent of the law and provides optimal flexibility and innovation, allowing for maximal scientific return on the investment of taxpayer funds.

Recommendation 2: I agree for the most part with this recommendation and it was one of the "lessons learned" from the 2014 SR: "*There should always be one Senior Review panel - not two that meet at separate times as there was in 2014. The Senior Review is for the Planetary Science Division, not the Mars Program and then everyone else. Having one panel assures that ALL missions are treated equally and fairly. Obviously, the composition of the panel will be critical to ensure fair treatment. In 2016, early identification of a panel chair who is involved in the selection of the panel should smooth this process*." However, I refer back to point A above. Given the cruise times and prime mission timelines for some missions to get to a destination and complete prime mission goals (it makes no sense to require a senior review before onset of the prime mission), inclusion of some missions in a specific SR would be pointless (I will return to this point later). Therefore, for all missions **that make sense to include in a given SR**, should be dealt with by one panel in order that each mission is treated fairly. However, those that fall outside the SR cycle due to cruise time, prime mission timelines and/or launch window should be treated the same as those that were part of the consolidated review. I have experience in this issue as I was part of the 2012 PSD SR and then chaired the out-of-sequence GRAIL SR. My experience was the principles and criteria that formed the basis of the consolidated SR were adhered to diligently when dealing with GRAIL. In the consolidated SR, we were not allowed to compare extended mission proposals. Each one was dealt with individually and we focused on the new science and observations that were proposed. GRAIL was treated no differently.

I would also like to address the issue of exclusion of projects from the SR process, highlighted on pages 4 and 5 of the IG Report. Given my statements in the paragraph above, I take exception to the statement "*We agree that this practice* [dealing with projects outside of the regular SR cycle] *leaves open the possibility that some projects may receive an unfair advantage by avoiding the standardization and scrutiny of the formal consolidated Senior Review process*." As stated previously, it is my experience that the same principles and criteria were applied to every mission, no matter when its mission extension proposal was reviewed. Contrary to the implication in the IG-Report, scientists are quite capable of acting consistently and objectively.

> **Missions Excluded from the 2012 SR**: The GRAIL mission was excluded from the 2012 SR because swift action was needed to ensure the spacecraft could survive a lunar eclipse and transition smoothly to the extended mission. The 2012 SR panel met at the end of June 2012, a month after the GRAIL primary mission ended (primary mission length was 5 months). Inclusion of GRAIL in the 2012 SR would have been too late to implement the extended mission. A similar scenario occurred for MESSENGER, where the formal data collection mission began on April 4, 2011. The primary mission was completed on March 17, 2012. These examples demonstrate that **it is vital for the PSD to maintain flexibility in its approach to the SR process**. The payoff because of this flexibility is exemplified by the fact that some of the results from the GRAIL extended mission are on the cover of *Science* magazine (8 February 2013, volume 339, issue 6120) and *Nature* magazine (2 October 2014, volume 514, number 7520), both highly respected and widely read international science journals. MESSENGER results adorned the cover of *Science* magazine (18 January 2013, volume 339, issue 6117).
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> **Missions Excluded from the 2014 SR**: The IG Report highlights three missions it feels should have been included in the 2014 SR – MESSENGER, Dawn, and MAVEN. The report does state that the end of mission for MESSENGER will be March 2015 when the spacecraft impacts the planetary surface, so it made absolutely no sense to include it in the 2014 SR. The

IG Report then states that both Dawn and MAVEN will have completed their prime missions before the next SR is due in 2016 and so these should have been included in the 2014 review. The fact is that Dawn is still currently in transit to Ceres and will not get there until March-April 2015 when it will start prime Dawn-at-Ceres science. Likewise, MAVEN was still in transit to Mars at the time of the 2014 SR and had not successfully been injected into orbit, let alone started its prime mission. In fact, at the time of writing this letter, MAVEN still has not begun its prime mission as it is still in the check-out phase. It is not credible that MAVEN and Dawn could have proposed mission extensions in 2014 when their prime missions had not started. A review of past extended mission proposals would clearly demonstrate that they are derivative from and extensions of the prime mission that make use of the prime mission phase to identify critical new scientific objectives and instrument capabilities. It would be a waste of time for the mission teams and for the SR panel to develop and review an extended mission proposal prior to the prime mission. In fact, it is entirely possible that developing an extended mission proposal may well have diverted the respective teams from managing the cruise stages of their missions so as to put the mission at increased risk.

Recommendation 3: The budget situation for the Planetary Science Division over the last two PSD Senior Reviews has fluctuated wildly (including a ~20% drop in the President's request for Planetary Science over 1 year). It is my opinion that PSD has managed the budget expectations as well as could be expected. This situation is compounded when Congress fails to pass spending bills and NASA is forced to operate under a Continuing Resolution. I found the criticism that resulted in this recommendation to be unfounded given the uncertain budgetary environment.

Recommendation 4: Developing a standardized approach for mission extension funding may make more sense for the Astrophysics, Heliophysics, and Earth Science Divisions of SMD. While missions for these 3 Divisions are generally localized to the near-Earth environment, the destinations for Planetary Science are highly variable, as are the distances to be traveled and the complexity of the mission (see "A" above). Standardizing the way extensions of these missions are handled would virtually remove the flexibility to innovate that is currently the hallmark of PSD extended missions. In this way, it would diminish the science return and, therefore, lower the return on investment of taxpayer dollars. If the standardized practice recommended by the IG had been implemented for those missions excluded from the 2012 and 2014 SRs, some of these may not have made it to the extended mission phase. Instead, we have seen outstanding and creative scientific return because mission teams were able to make the most of the prime mission to identify new opportunities to make major advances in science.

In conclusion, I submit to you that the Planetary Science Division of SMD cannot conduct standardized, completely consolidated Senior Reviews. I strongly believe that if the recommendations are forced on the PSD, the science of exploration will be diminished and even jeopardized. This will reduce the return on taxpayer investment and we will see a decline in US leadership in robotic exploration of our Solar System that I for one do not want to see happen.

Sincerely yours,

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cc: John Grunsfeld, AA-SMD
James Green, Director-PSD
Planetary Community