

# Planetary Protection Independent Review Board

*Presentation to MEPAG*

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# PPIRB Background

- PPIRB Term: July-September 2019
- PPIRB Membership: Planetary scientists, biologists, private and civil sector space reps.
- Charter Summary: “An assessment to include analysis of the scientific, engineering, industrial, legal, and program management aspects of planetary protection.”
- Meetings/Telecons: 4 in person multi-day meetings; 11 working telecons.
- Report: Reviewed within NASA prior to delivery. Released 18 Oct 2019.
- Next Step: NAS Review.

# Findings and Recommendations Overview

- Approximately 80 Findings and Recommendations, including:
  - Clarifying and Streamlining PP Processes within NASA
  - Advancing PP Protocols with More Modern Technology
  - Reducing PP Burdens on Missions
  - Advancing PP Policies for Private Sector Missions
  
- Topics in PPIRB report:
  - General/Overarching
  - PP Categorization
  - Human Spaceflight
  - Private Sector Initiatives and Missions
  - Robotic Mars Sample Return
  - Ocean Worlds Exploration
  - COSPAR

# Example Findings & Recs: PP Evolution

- Major Finding: The context in which PP is conducted is profoundly and rapidly changing...The PPIRB findings and recommendations presented in this report apply to the current era and generally are made with a 3-5 year horizon in mind.
- Major Finding: The PPIRB applauds SMD's and OSMA's recent revamping of the PPO and the work of the new PP officer, which has increased communication, clarity and responsiveness to community needs and concerns.
- Supporting Finding: The scope of Planetary Protection landscape is complex, broad, nuanced, and sometimes politically charged. The PPIRB could only evaluate it at a top level in the time and resources allocated for our review.
  - Major Recommendation: Because of advances in knowledge and technologies since the Viking era, NASA's PP policies and implementation procedures should be reassessed.
  - Major Recommendation: NASA should reassess its PP guidelines at least twice per decade with an IRB-like body.
  - Major Recommendation: NASA should establish a standing forum for the discussion and resolution of emergent PP issues that includes input from government, private sector, and perhaps even non-US private sector enterprises.

# Findings & Recs: Mars-Related Categorization

- Major Finding: As more is learned about each celestial body, more detailed and tailored approaches to forward contamination become advisable. These include variable categorization based on surface/subsurface location, where and how many times past missions have investigated the body, and the survivability and propagation of terrestrial organisms in the body's environments.
- Supporting Finding: Various scientific studies (4,5,6,7) suggest that the survival and amplification of terrestrial biota are unlikely on the Martian surface, which would support classification of much of the Martian surface as Category II.
  - Major Recommendation: NASA should reconsider how much of the Martian surface and subsurface could be Category II vs. IV.
  - Major Recommendation: NASA should consider establishing (i) high priority astrobiology zones, i.e., regions considered to be of high scientific priority for identifying extinct or extant life, and (ii) human exploration zones, i.e., regions where the larger amounts of biological contamination inevitably associated with human exploration missions, as compared to robotic scientific missions, will be acceptable.

# Findings & Recs: Mars Sample Return

- Major Finding: Martian material has been naturally transported to Earth for billions of years.
  - Major Recommendation: NASA's MSR PP approach should take into account the findings of the recent National Academies' Consensus Study Report on sample return from the Martian moons.
- Supporting Finding. Significant work is being done to study the MSRF and whether an entirely new facility should be built, and where, or whether the MSRF should be an add-on to an existing Biosafety Level 4 (BSL-4) facility.
- Major Finding: As the first restricted Earth return since Apollo, MSR will be a uniquely high profile mission.
  - Major Recommendation: Planning for a Mars Sample Receiving Facility (MSRF) should be accelerated, and should be kept as pragmatic as possible so as not to unduly drive the cost or schedule of MSR.
  - Major Recommendation: NASA should begin work with other government agencies to develop a MSR PP public outreach, communications, and engagement plan.
- Supporting Finding: Some types of sterilization of Mars samples are antagonistic to many important types of scientific measurements.
  - Supporting Recommendation: NASA should carefully trade the implications of the degree and types of PP sterilization techniques for Mars samples with the implications for various types of science measurements.
  - Supporting Recommendation: NASA should continue to engage experts from the medical, pharmaceutical, and personal care industries to advise on effective sterilization protocols.

# Findings & Recs: Humans to Mars (1)

- Major Finding: Human missions to Mars will create new opportunities for science and exploration.
- Major Finding: PP planning for human missions to Mars and the communication of those plans to the public are presently immature.
  - Major Recommendation: NASA should expeditiously develop PP guidelines for human missions to Mars, whether those missions are conducted by NASA, other international agencies, or private entities.
  - Major Recommendation: NASA should begin, sooner rather than later, preparing for the public communication of all aspects of PP planning for human missions to Mars, and should pay special attention to public PP concerns, similarly to NASA's proactive treatment of NASA missions involving radioisotope power systems.
- Major Finding: Human missions to Mars will inevitably introduce orders of magnitude more terrestrial microorganisms to Mars than robotic missions have done or will do.
- Major Finding: NASA's current policies for robotic Category V Restricted Earth Return from Mars appear to be unachievable for human missions returning from Mars.
  - Major Recommendation: Regarding the return of humans and equipment from Mars, NASA should invest in developing more informed, backward contamination PP criteria, considering protection of Earth's biosphere, the feasibility of mission implementation, and the potential for *in situ* hazard characterization on Mars.
  - Major Recommendation: Special attention should be paid to assess how astrobiological research can be carried out in the presence of human activities.

# Findings & Recs: Humans to Mars (2)

- Supporting Finding: Terrestrial biology has been transported to Mars by previous robotic missions at discrete locations, although at low levels as compared to what is likely on future crewed and crew-related missions. The impact that these already transported organisms have had on any global Mars ecosystem is unknown but is likely to be minimal.
  - Supporting Recommendation: In considering crew return from Mars, NASA should assess the acceptability of the multi-month return trajectory as a PP quarantine and evaluation period, potentially simplifying terrestrial quarantine scenarios, requirements, and timescales.
  - Supporting Recommendation: NASA should review COSPAR's humans to Mars principles and guidelines to assess which should be followed, discarded, or updated for NASA's first human Mars expedition.