

Office of Planetary Protection's Response to External Reviews

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Assurance

Artist concept of return orbiter capturing the OS

<https://mars.nasa.gov/resources/3533/rendezvous-in-martian-orbit/>

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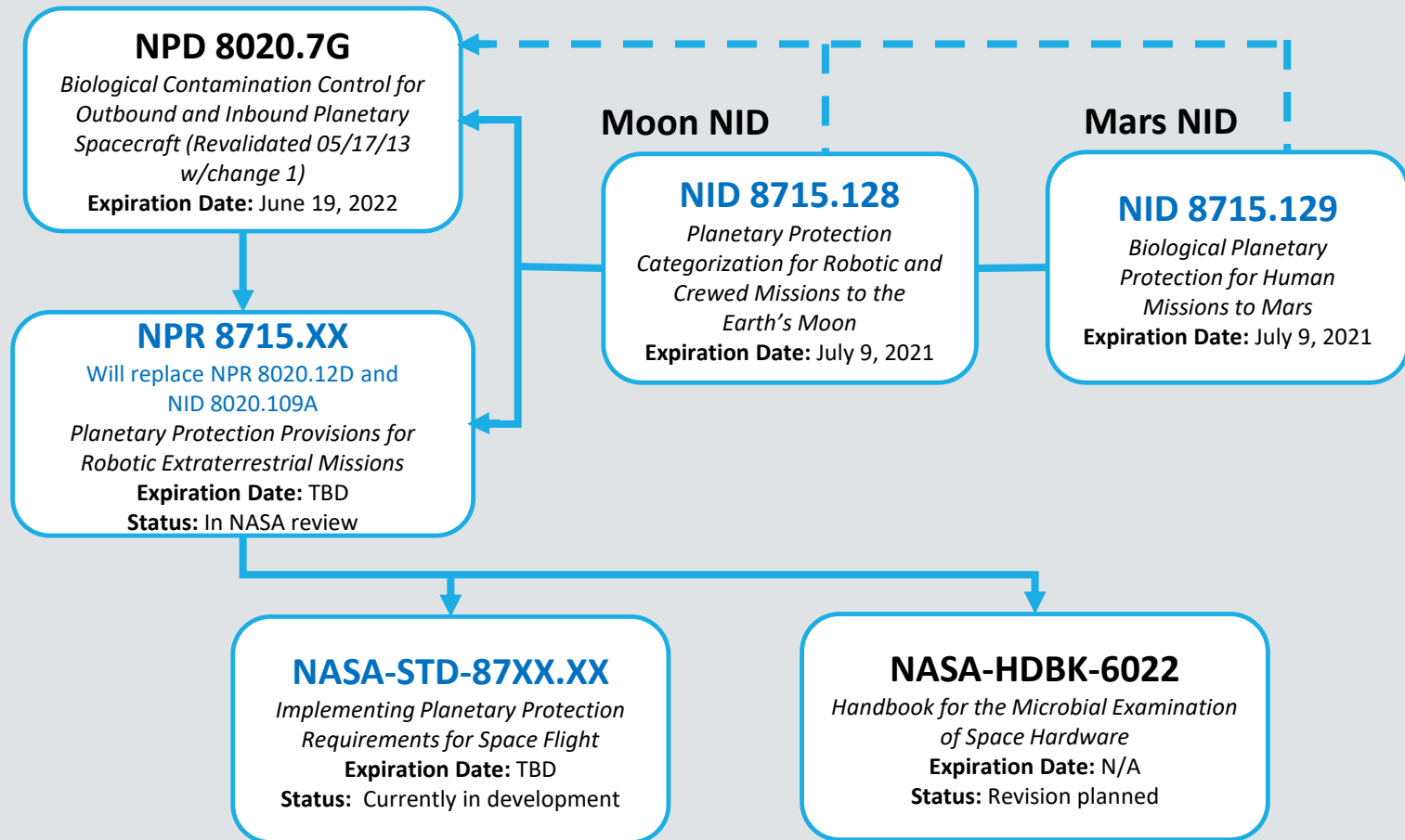


Meeting U.S. Obligations 1967 Outer Space Treaty

- NASA conducts exploration in compliance with Article IX:
*"...States Parties to the Treaty shall pursue studies of outer space, including the moon and other celestial bodies, and conduct exploration of them so as to **avoid their harmful contamination and also adverse changes in the environment of the Earth** resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose...."*
- As commercial and private activities increase, NASA works with federal agencies to comply with Article VI: *"...The activities of non-governmental entities in outer space, including the moon and other celestial bodies, shall require **authorization and continuing supervision** by the appropriate State Party to the Treaty."*



NASA's Current Policy Documents





RECENT EXTERNAL REVIEWS OF NASA'S PLANETARY PROTECTION POLICY

1. NASEM Review and Assessment of Planetary Protection Policy Development Processes (2018)
2. *Review by the Science and Technology Policy Institute (STPI), *Towards the Development of a National Planetary Protection Policy (2019)*
3. Report from NASA's Planetary Protection Independent Review Board (2019)
4. NASEM Review of the Report of NASA's Planetary Protection Independent Review Board (2020)

*Report not available to public. Distributed to House Committee on Science, Space, and Technology.



NASEM Review of the Report from PPIRB

Review of the PPIRB identified three areas of strategic importance in the development of future planetary protection policy common to both NASEM (2018) and PPIRB (2019) reports:

- Establishing a new advisory process.
- Clarifying legal and regulatory issues.
- Building the scientific and technical foundations of planetary protection policies for human missions to Mars.



Committee on Planetary Protection (CoPP) at National Academies

CoPP will cover those aspects of planetary environments, life sciences, spacecraft engineering, technology, and science policy relevant to the control of biological cross-contamination arising from robotic missions and human exploration and utilization of solar system bodies.

CoPP will serve as a source of advice on measures undertaken to protect the biological and environmental integrity of extraterrestrial bodies (forward contamination) and to preserve the integrity of Earth's biosphere (backward contamination).

SMD and OPP determine specific topics and deadlines for CoPP assessment.



Current Members CoPP Review Lunar Contamination Sensitivity

Mr. Joseph K. Alexander (chair) Dr. David M. Karl
Dr. Angel Abbud-Madrid Dr. Eugene H. Levy
Dr. Anthony Colaprete, Dr. Robert E. Lindberg Jr.,
Dr. Michael J. Daly Dr. Margarita M. Marinova
Mr. David P. Fidler, Dr. A. Deanne Rogers,
Ms. Sarah A. Gavit Dr. Gerhard H. Schwehm
Dr. Amanda R. Hendrix Dr. Trista J. Vick Majors
Dr. Andrew Horchler



HEO Capabilities Gap Analysis

OPP participates in the Exploration Capability Gap data call by Human Exploration and Operations Mission Directorate (HEOMD) for knowledge and technology gap closure for Moon 2 Mars exploration missions. Currently, 22 Planetary Protection gaps (example below).

Example PP Gaps Submitted:

Capability Gap Title	Gap Description	Current State of the Art (SoA) Performance Metrics	Minimum Acceptable Performance Metrics for Exploration Missions	Impacts if Not Closed	If No Projected Gap Closure (only respond if response in column 5 is No):	Testing and Demo Platform	Validation Platform	Platforms Enhanced or Enabled	Elements Enabled
Requirements for Microbial Monitoring of Environments for Detection of Forward and Backward Contamination	Currently, very little is known about the potential for terrestrial microbes to survive on the surface and shallow subsurface of Mars. Environmental monitoring techniques will be needed to quantify background levels in crewed spacecraft and to monitor the levels of terrestrial microbes in Mars surface environments once humans are present.	Culturing or genomics/proteomics are the two established methods for identification and quantification of terrestrial microbes. Both methods require specialized laboratory instrumentation. Wet chemical and instrumented protocols will need to be developed for the use in microgravity and at the surface of Mars. MinION is the only flight-	A wet chemical and instrumented sequencing will be successful when an end-to-end process is available for detection of microbial biomass at low concentrations (TBD) in relevant environmental samples. Minimum Acceptable Performance is TBD but likely to be in the range of 100-1,000 cells per cubic centimeter of Martian material.	Current solutions may be effective in proximity to humans but will provide virtually no information on environmental samples collected outside the habitat or vehicles. We will be unable to detect if humans are contaminating Mars or if Mars is contaminating the human crew.	Risk that planetary protection requirements will not be met, harmful contamination of the planet results, together with degradation of future science and our ability to tell if Mars has (or ever did have) life. Policy decision is also required (based on data acquired) to determine permitted threshold levels.	Ground Testing	Robotic Lunar Surface	Robotic Mars Surface Human Mars Surface	Mars xEVA, Mars Habitable Mobility Platform (HMP), Mars ISRU Systems, Long-Duration Mars Surface Habitat
Requirements for Microbial Monitoring of Human Health	On Earth, humans are an inexhaustible supply of microbes. More information is needed to understand how human microbial systems may change once introduced to long-term space transport and exposure to the Mars environment.	Culturing or genomics/proteomics are the two established methods for identification and quantification of terrestrial microbes. Both methods require specialized laboratory instrumentation. Wet chemical and instrumented protocols will need to be developed for	Ability to discriminate changes in the human microbiome as an indicator of health between exposure to a potential Martian organism and long-term exposure to space and extraterrestrial environments.	Returning human crew could potentially carry an undetected harmful Martian organism, thereby failing to meet backward planetary protection requirements.	Risk to crew health, ability of crew to (be permitted to) return to Earth. Policy decision is also required (based on data acquired) to determine acceptable risk levels	LEO (ISS & Freeflyers)	Human Lunar Surface	Human Mars Surface	Mars xEVA, Mars Habitable Mobility Platform (HMP), Mars ISRU Systems, Long-Duration Mars Surface Habitat



ISS4Mars Workshop

- OPP is participating in the ISS4Mars workshop which is evaluating the use of ISS to develop and test technologies needed for Mars transit and Mars surface systems and operations.
- Planetary protection has links into the microbiology of closed systems/environments and into astronaut health, and OPP participation will ensure that topics interfacing with PP concerns are addressed.
- OPP will be participating in a breakout session focused on humans living in a closed but leaky environment and a session on considerations for the human microbiome and microbial monitoring.



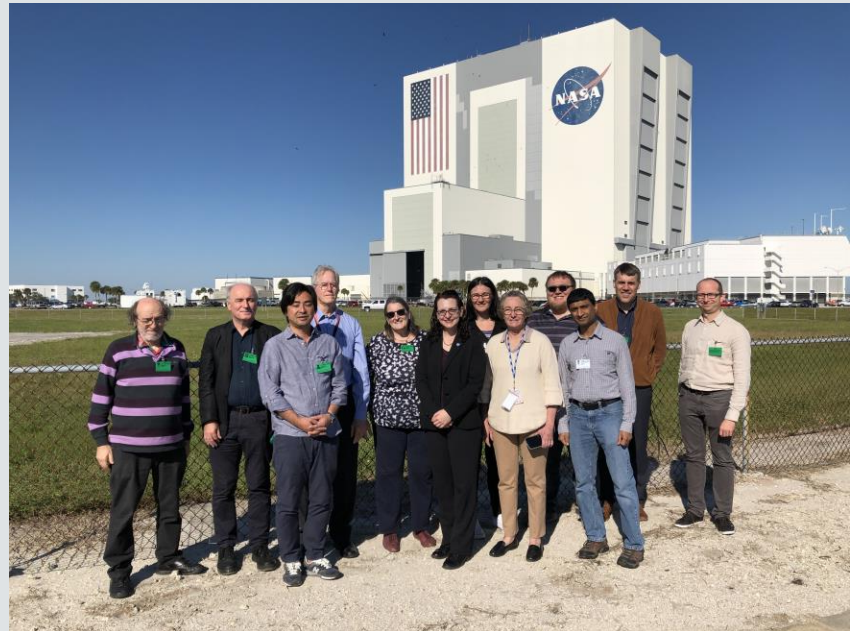
Sample Safety Assessment Protocol (SSAP) Working Group

Established by COSPAR in 2018

Assess if there are indications of martian life (extant or extinct) in martian samples or on particles adhering to spacecraft hardware and if samples or particles constitute a biological hazard to the terrestrial biosphere, while maintaining the scientific integrity of the overall material from Mars to the maximum extent possible.

NASA Representation on SSAP:
Michael Meyer, Lisa Pratt, Danny
Glavin, and Francis McCubbin

Final report anticipated in 2021
with preliminary findings
presented at COSPAR Assembly
Jan/Feb 2010





Initiation of Interagency Activity

In 2019, the White House Office of Science and Technology Policy (OSTP) requested that the IDA Science and Technology Policy Institute (STPI) review current planetary protection policies and approaches and provide policy options to inform OSTP in reviewing and updating national planetary protection policies.

In 2020, OSTP and the National Space Council (NSpC) invited NASA and ~15 other agencies and offices to participate in an interagency working group (IWG) to determine next steps towards the development of a national planetary protection policy.

NASA representation on IWG: Mike Gold, Margaret Kieffer, Lisa Pratt, Ursula Rick