

THE COSPAR POLICY ON PLANETARY PROTECTION : UPDATES FOR LUNAR EXPLORATION. A. Coustenis¹, N. Hedman², G. Kminek³, the COSPAR Panel on Planetary Protection⁴ ¹LESIA, Paris Observatory, PSL Univ., Paris Univ., CNRS, 5 place Jules Janssen, 92195 Meudon, France, athena.coustenis@obspm.fr, ²Committee, Policy and Legal Affairs Section, United Nations Office for Outer Space Affairs, Vienna, Austria, ³European Space Agency, Noordwijk, The Netherlands, ⁴<https://cosparhq.cnes.fr/scientific-structure/ppp>

Introduction: This paper provides updates on the most recent evolution of the COSPAR Planetary Protection Policy as concerns future lunar exploration. The international standard for planetary protection has been developed by the Committee on Space Research (COSPAR) which provides a forum for international consultation and has formulated a Planetary Protection Policy with associated requirements that are put in place after examination of the most updated relevant scientific findings and studies and recommendations made by the COSPAR Panel on Planetary Protection.

The COSPAR Planetary Protection Policy, and its associated requirements, is not legally binding under international law but it is the only internationally agreed planetary protection standard with implementation guidelines for reference in compliance with Article IX of the United Nations Outer Space Treaty of 1967 and other relevant international agreements [1,2, 3], that stipulate that exploration must be conducted in a manner that avoids harmful forward and backward contamination. States Parties to the Outer Space Treaty are responsible for national space activities under Article VI, including the activities of governmental and non-governmental entities. It is the State that ultimately will be held responsible for wrongful acts committed by its jurisdictional subjects.

The COSPAR Panel on Planetary Protection (PPP) is the tool through which the Policy is maintained and updated as necessary. Among recent such updates was one relevant to the lunar exploration as described hereafter.

The COSPAR Panel on Planetary Protection role and structure: The current members of the COSPAR Panel on Planetary Protection are representatives from national space agencies (e.g. China, France, Germany, India, Italy, Japan, the Russian Federation, Canada and the United States) and thematic experts from the science community of different countries (<https://cosparhq.cnes.fr/scientific-structure/ppp>). Other stakeholders, including the private sector, are invited to attend and present at the meetings. [1,2].

The COSPAR Panel on Planetary Protection maintains and updates the COSPAR Planetary Protection Policy, and its associated requirements, regularly in various ways. In all cases, the Panel reviews all available scientific knowledge through existing or

commandeered studies performed by a group or committee of experts who review the information and make a recommendation to the Panel.

The COSPAR Panel on Planetary Protection has as a main goal to develop, maintain, and promote the COSPAR Policy and associated requirements [1,2] that must be achieved to protect against the harmful effects of forward and backward biological contamination and to guide compliance with the Outer Space Treaty ratified today by 110 nations, i.e.

- The conduct of scientific investigations of possible extraterrestrial life forms, precursors, and remnants must not be jeopardized.
- In addition, the Earth must be protected from the potential hazard posed by extraterrestrial matter carried by a spacecraft returning from an interplanetary mission.

The COSPAR Planetary Protection Policy has five different categories, depending where a specific space mission is going and what the mission objectives are. Associated to these five categories are requirements with various degrees of stringency. Using this categorisation approach, COSPAR determines whether a mission is low risk or high risk. The five Categories of Planetary Protection outline the recommended measures that an agency should apply to each mission.

Recent activities of the Panel:

Workshops, dedicated scientific and technical meetings and independent peer reviews are all integral part in updating the COSPAR Planetary Protection Policy, and its associated requirements. Taking these documented inputs into account, the Panel recommends (or not) to the COSPAR Bureau and Council possible modifications to the Policy and its associated requirements. Such updates are done in a careful and balanced way to ensure that the right measures are envisaged to fulfil the rationales for planetary protection. The purpose obviously is to respond to the needs of space missions, while applying due diligence and expertise in the process.

The Panel has recently worked on a case that was brought to our attention by the managers of the JAXA-led MMX mission, where we issued a special categorization for an unrestricted Earth return, since the studies showed that the samples returned from Phobos

would not present a threat for the Earth's biosphere after careful handling and processing.

In another case, recent findings concerning the outer solar system icy moons, led to different studies conducted by several countries and the European commission, as well as by ESA and NASEM-SSB, which recommended an update of the requirements for Europa and Enceladus (see *The International Planetary Protection Handbook: Dec. 2018*). These recommendations were submitted to the COSPAR PPP, which was involved throughout the whole multi-year process and in the end suggested updating of the requirements for missions to Europa and Enceladus to the COSPAR Bureau, which have been accepted and led to a revision of the COSPAR Policy published in August 2020 [3].

These studies were published in a special issue of *Life Sci. Space Res.* (2019, Vol. 23) on "Planetary protection: New aspects of policy and requirements".

Updated COSPAR Policy on Lunar Exploration



Image credit: NASA Lunar Reconnaissance Orbiter

Our satellite offers insights on many outstanding questions related to various fields like bombardment, volcanism and impacts but also atmospheric and dust environment, astrobiology and life sciences. In particular, the study of lunar polar volatiles available in lunar cold traps mostly near the poles (called Permanently Shadowed Regions or PSRs) has relevance to the broader solar system science as analogs for volatile and water availability in comets, asteroids and other small bodies and the formation of inner planets in our solar system and beyond. Following recent findings and renewed interest in lunar exploration, the PPP conducted a dedicated survey on the PSRs and reviewed reports and studies. This led to an updated COSPAR Policy [5] with two new sub-categories:

- Cat. IIa: all missions to the surface of the Moon whose nominal mission profile does not access areas defined in Cat IIb: material inventory limited to organic products that may be released into the lunar environment by the propulsion system.

- Cat. IIb: all missions to the surface of the Moon whose nominal mission profile accesses PSRs and the lunar poles, in particular latitudes south of 79S and north of 86N: full organic inventory (solid and volatiles).

Planetary protection technologies are developed in many places for cleaning and sterilizing spacecraft and safely handling soil, rock, and atmospheric samples. For instance, in the study of whether Mars or the icy moons have environments conducive to life, precautions are taken against introducing microbes from Earth (forward contamination). The primary strategy for preventing contamination of Mars or the icy moons with Earth organisms is to be sure that the hardware intended to reach the planet is clean. If we contaminate the environments we want to investigate with our spacecraft, we destroy any chance of properly studying such unique environments and lose information on the formation and evolution of our solar system.

At the same time, we work towards ensuring a safe preservation of our biosphere upon return of the matter to Earth (backward contamination).

Planetary protection guidelines are there to enable safe scientific space exploration for long periods of time and to ensure the protection of our planet Earth.

The structure and composition of the Panel, as well as all documents related to the Panel's activities, can be found at the COSPAR web site dedicated page: <https://cosparhq.cnes.fr/scientific-structure/ppp>.

References:

- [1] Coustenis, A., Kminek, G., Hedman, N. (2019) The challenge of planetary protection. *ROOM Journal*, June 2019, 44-48. [2] Coustenis, A., Kminek, G., Hedman, N., et al. (2019) The COSPAR Panel on Planetary Protection role, structure and activities. *Space Res. Today* 205, 14-26. DOI: [10.1016/j.srt.2019.06.013](https://doi.org/10.1016/j.srt.2019.06.013). [3] COSPAR Panel on Planetary Protection, (2020) COSPAR Policy on Planetary Protection. *Space Res. Today* 208, August 2020, 10-22. DOI: [10.1016/j.srt.2020.07.009](https://doi.org/10.1016/j.srt.2020.07.009). [4] The COSPAR Panel on Planetary Protection (2020) Planetary Protection Policy: For sustainable space exploration and to safeguard our biosphere. *Research Outreach* 118, 126-129. DOI: 10.32907/RO-118-126129. [5] Fisk, L., Worms, J.-C., Coustenis, A., Hedman, N., Kminek, G., Ammanito, E., Doran, P., Fujimoto, M., Grasset, O., Green, J., Hayes, A., Ilyin, V., Kumar, P., Nakamura, A., Olsson-Francis, K., Peng, J., Prieto Ballesteros, O., Raulin, F., Rettberg, P., Viso, M., Xu, K., Zaitsev, M., Zorzano Mier, M.-P., 2021. *Space Research Today* 211, 9-25 <https://doi.org/10.1016/j.srt.2021.07.010>