

NASA Advisory Council Recommendation

Environmental Impacts in Extraterrestrial Missions 2022-02-09

Name of Committee:	Science Committee
Chair of Committee:	Dr. Ellen Williams
Date of Council Public Deliberation:	August 10, 2022
Short Title of Recommendation:	Environmental Impacts in Extraterrestrial Missions

Recommendation:

The Council recommends that:

- In addition to biological and chemical contamination, the Science Mission Directorate (SMD) consider and document other environmental impacts at extraterrestrial environments that could affect future science activities including, but not limited to, discarded or waste materials, electromagnetic spectrum pollution, and impacts such as formation of long-lasting dust clouds.
- SMD determine a lead entity responsible for considering strategies for mitigation of non-biological impacts on extraterrestrial environments while ensuring that potential mitigation strategies consider current and future science needs. To the extent possible, this should be an international discussion.

Major Reasons for the Recommendation:

NASA's Planetary Protection effort continues to evolve and integrate issues of biological and chemical contaminants into operational planning for new missions.

Consequences of No Action on the Recommendation:

The standard focus within the science community of mitigating the possibility of biological or chemical contamination fails to address the continuing awareness of other possible pollutants such as electromagnetic spectrum pollution. Failure to address this recognition could jeopardize the success of future science missions.

NASA Response:

NASA concurs with the first part of the recommendation, that SMD consider and document other environmental impacts at extraterrestrial environments that could affect future science activities. NASA's Planetary Protection requirements establish the thresholds for bioburden on outbound spacecraft and require an inventory of potential contaminants. Additionally, the probability of biological contamination is determined for missions where the target has a categorization level that is required. The NASA Planetary Protection policy governing lunar missions also protects sites of historical relevance from biological and chemical contamination.

Enclosure

In Earth orbit, untracked millimeter-sized orbital debris presents the highest mission-ending risk to spacecraft. NASA is working to reduce uncertainties in debris modeling as the first step in supporting the development and implementation of cost-effective, protective measures for safe operations of future missions. NASA also developed a best practices handbook, in coordination with the Departments of Defense and Commerce, to mitigate collisions in orbit to avoid the loss of spacecraft and the creation of additional orbital debris. This handbook is publicly available and is used domestically and internationally. SMD is engaging with industry on potential mitigation strategies for minimizing interference impacts from large satellite fleets such as field of view obstructions, optical interference, optical damage due to lasers, communications/radio frequency interference, potential loss of data, increases in conjunctions, and cost increases prohibiting the operation of NASA missions in specific orbits.

NASA concurs with the second part of the recommendation, in that NASA SMD is the lead entity responsible for considering strategies for mitigation of non-biological impacts on extraterrestrial environments while ensuring that potential mitigation strategies consider current and future science needs. Within NASA, SMD engages with the Offices of the Chief Engineer, Safety and Mission Assurance, Chief Scientist, International and Interagency Relations, and other relevant offices as needed to ensure that SMD activities in extraterrestrial environments mitigate potential impacts to current and future science needs. NASA also engages regularly with other U.S. Government agencies, international partners, and commercial and academic experts on issues involving mitigation of harmful impacts to extraterrestrial locations. To the extent possible, and consistent with NASA practice to date, Agency discussions on mitigation of non-biological impacts on extraterrestrial environments are held with international partners and addressed in subsequent agreements between the parties.