



# Planetary Protection for Discovery Phase A Studies

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9 Nov. 2015

# NASA Planetary Protection Policy:

## *Protect Science, Protect the Earth*



### NASA Policy Directive 8020.7G:

- “The conduct of scientific investigations of possible extraterrestrial life forms, precursors, and remnants must not be jeopardized.”
  - *avoid forward contamination: don't “discover” life we brought with us*
- “In addition, the Earth must be protected from the potential hazard posed by extraterrestrial matter carried by a spacecraft returning from another planet or other extraterrestrial sources.”
  - *avoid backward contamination: don't contaminate the Earth*
- “Therefore, for certain space-mission/target-planet combinations, controls on organic and biological contamination carried by spacecraft shall be imposed in accordance with directives implementing this policy.”
  - *tailor requirements by target location and mission type: don't require unnecessary measures*

# International Obligations



- The Outer Space Treaty of 1967

- Proposed to the UN in 1966; Signed in January 1967
- Ratified by the US Senate on April 25th, 1967

- Article IX of the Treaty states that:

“...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...”



- The Committee on Space Research of the International Council for Science maintains an international consensus policy on planetary protection

- COSPAR policy represents an international scientific consensus, based on advice from national scientific members, including the US Space Studies Board
- COSPAR is consultative with the UN (through UN COPUOS and the Office of Outer Space Affairs) on measures to avoid contamination and protect the Earth under the Treaty
- NASA and ESA policies specify that international robotic missions with agency participation must follow COSPAR policy, providing a consensus basis for requirements
- COSPAR policy requires an inventory of microbial diversity carried on spacecraft

# NASA Requirements: Planetary Protection Mission Constraints

Planetary Protection



- Depend on the nature of the mission and on the target planet
- Assignment of categories for each specific mission/body is to “take into account current scientific knowledge” via recommendations from advisory groups (SSB, PPS).
- Examples of specific measures include:
  - Documentation of spacecraft trajectories and spacecraft material archiving
  - Spacecraft organic inventory and restrictions
  - Constraints on spacecraft operating procedures
  - Reduction of spacecraft biological contamination
  - Restrictions on the handling of returned samples



W. Peet, 1967

# NPR 8020.12D (*E released 4/16*): Planetary Protection Mission Categories

Planetary Protection



PLANET PRIORITIES	MISSION TYPE	MISSION CATEGORY
A Not of direct interest for understanding the process of chemical evolution. No protection of such planets is warranted.	Any	I
B Of significant interest relative to the process of chemical evolution, but only a remote chance that contamination by spacecraft could compromise future investigations. Documentation is required.	Any	II
C Of significant interest relative to the process of chemical evolution and/or the origin of life and for which scientific opinion provides a significant chance of contamination which could compromise future investigations. Substantial documentation and mitigation is required.	Flyby, Orbiter	III
	Lander, Probe	IV
All Any Solar System Body	Earth-Return <i>“restricted” or “unrestricted”</i>	V

# Planetary Protection Documentation Schedule

Planetary Protection



## Mission Categorization

- Communicate with PPO in pre-Phase A
- Formal request to PPO during Phase A (discuss implementation by SRR)
- Categorization letter received by KDP B

## Planetary Protection Plan (II-V)

- Drafted during Phase B (consult with PPO)
- Released by PDR (included in review)
- Approved by KDP C

## Pre-launch Planetary Protection Report

- due 90 days prior to Launch; (Launch Certification at FRR for Cat. III-Vr)

## Post-launch Planetary Protection Report

- due 60 days post Launch

## Extended Mission Planetary Protection Plan

- Approved prior to end of original Phase E (KDP F)

## End-of-Mission Report

- due 60 days after End of Mission

# Categorizations are Determined



- On a mission-by-mission basis
- Based on recommendations from the Planetary Protection Subcommittee of the NASA Advisory Council
- Considering advice from the Space Studies Board of the National Research Council

# Category II Requirements for Non-Habitable Objects

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## Documentation:

- Planetary Protection Plan (what the project will do)
- Pre-Launch Planetary Protection Report (what was done so far)
- Post-Launch Planetary Protection Report (is the spacecraft working?)
- (Extended Mission Plan, if relevant)
- End-of-Mission Report (where did it go, where is it now)
- *Microbial Inventory is a possible future requirement on Venus missions*

Standard spacecraft assembly procedures  
(cleanrooms, etc.)

# Additional Considerations



- All missions crossing Mars orbit must document a  $1 \times 10^{-4}$  probability that launch vehicle hardware could impact Mars for a period of 50 years after launch
- End-of-mission scenarios that account for the disposition of a radioisotope power source may choose to demonstrate orbital lifetime beyond the effective lifetime of the heat source, a burn-up/break-up analysis demonstrating that the heat source would not create a biological contamination concern, or directed disposal of the spacecraft into an object that is not of concern for biological contamination

*Missions must address the potential for creating an habitable environment, or facilitating transport to such locations, if a heat source is present*

# The Basic Rationale for Planetary Protection Precautions

(as written by Bart Simpson, Dec. 17, 2000, "Skinner's Sense of Snow")



**Science class should not end in  
tragedy...**

**Science class should not**

