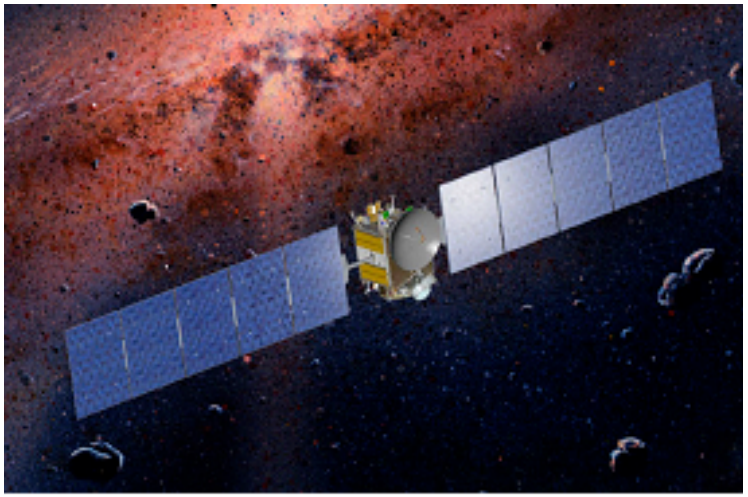
Planetary Protection



for the Dawn Mission

Catharine Conley, NASA HQ
14 Jan. 2013

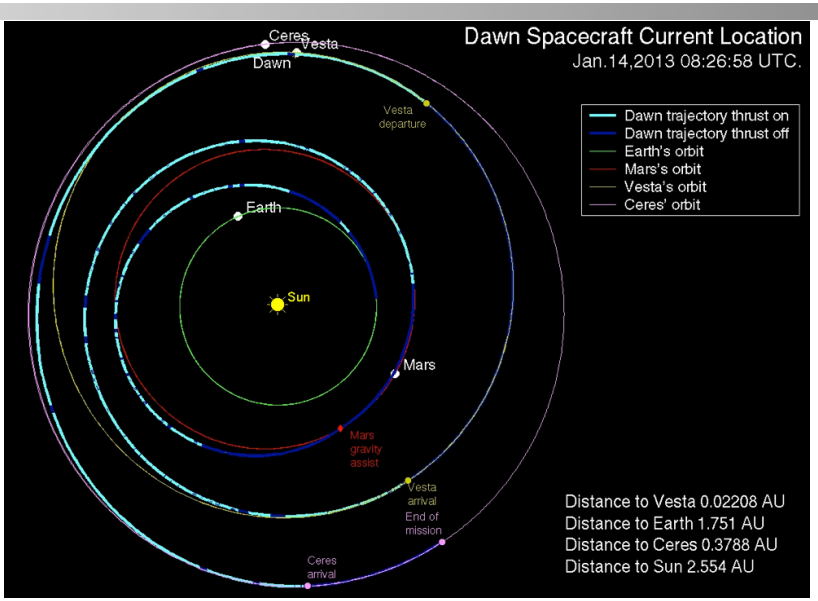
NASA Planetary Protection Policy

- "The conduct of scientific investigations of possible extraterrestrial life forms, precursors, and remnants must not be jeopardized."
  - Preserves science opportunities directly related to NASA's goals; originally recommended to NASA by the NAS in 1958
  - Preserves our investment in space exploration
- "The Earth must be protected from the potential hazard posed by extraterrestrial matter carried by a spacecraft returning from another planet."
  - Preserves Earth's biosphere, upon which we all depend...
- Assignment of categories for each specific mission/body is to "take into account current scientific knowledge" via recommendations from advisory groups, including the Space Studies Board and the Planetary Protection Subcommittee of the NASA Advisory Council.

Planetary Protection Mission Categories

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 jeopardize future exploration. Documentation is required.	Any	II
C	Of significant interest relative to the process of chemical evolution and/or the origin of life or for which scientific opinion provides a significant chance of contamination which could jeopardize a future biological experiment. Substantial documentation and mitigation is required.	Flyby, Orbiter	III
		Lander, Probe	IV
All	Any Solar System Body	Earth-Return	V
		"restricted" or "unrestricted"	

Dawn: a Category III Mars Flyby mission



Standard Requirements

- Class 100K cleanroom assembly
- Probability of spacecraft impact on Mars < 10^{-2}
- Probability of launch vehicle impact on Mars < 10^{-4}

Mission-Specific Requirements

- "Orbital lifetime around Ceres of greater than 20 years post-orbital-insertion"
- "Refine orbital lifetime estimate based on improved gravity model at Ceres, and provide in letter to PPO prior to EOM"
- "Provide data bearing on the biological interest of Ceres ... before mission operations preclude obtaining an extended orbital lifetime above 20 years. If further protection is warranted, the 20-year lifetime mission design requirement will be considered a minimum"

What is ‘biological interest’?

- Planetary protection is concerned with the introduction of Earth life into locations where it could grow: available water, at temperatures that could support life
- SSB, PPS, and COSPAR deliberations on icy objects consider the potential for introducing unsterilized spacecraft hardware into areas with warm ice or liquid water
- Should evidence for recent melting be observed at Ceres, a planetary protection review would be held to evaluate options for further mission operations:
  - Enter a long-term stable orbit around Ceres
  - Leave Ceres orbit
  - Other?
- If protection for biological contamination is not necessary, then the project may request a release from the 20 year orbital lifetime requirement

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....
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Science class should not

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