

THE NATIONAL ACADEMIES

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Space Studies Board

500 Fifth Street, NW
Washington, DC 20001
Phone: 202 334 3477
Fax: 202 334 3701
E-mail: ssb@nas.edu
www.nationalacademies.org/ssb

April 11, 2012

Dr. John Grunsfeld
Associate Administrator
Science Mission Directorate
NASA Headquarters
300 E. Street, SW
Washington, DC 20546-0001

Dear Dr. Grunsfeld:

I am pleased to provide you with prepublication-format copies of the report *Assessment of Planetary Protection Requirements for Spacecraft Missions to Icy Solar System Bodies*. This report has been prepared by the Space Studies Board's (SSB's) Committee on Planetary Protection Standards for Icy Bodies in the Outer Solar System in response to a request from your predecessor, Dr. Edward J. Weiler.

Specific advice regarding forward contamination issues related to spacecraft missions to Europa and, by extension, other icy bodies is contained in the SSB's 2000 report, *Preventing the Forward Contamination of Europa*. But, in the dozen years since that report was published there have been significant advances in our understanding of the environmental conditions in the outer solar system. In addition, there have been great improvements in the understanding of the biological, chemical, and physical factors determining the ability of terrestrial organisms to survive in extreme environments. Thus, it was appropriate to review the 2000 report and to update and extend its conclusions and recommendations to the entire range of icy bodies in the outer solar system—i.e., asteroids, satellites, Kuiper belt objects and comets—in light of new information and understanding.

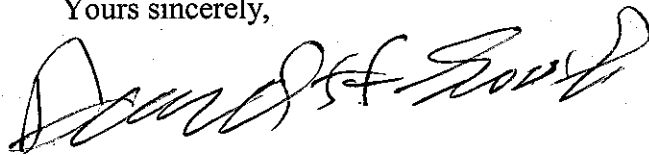
Dr. Weiler specifically requested that the new report addresses the following topics:

- The possible factors that usefully could be included in a Coleman-Sagan formulation describing the probability that various types of missions might contaminate with Earth life any liquid water, either naturally occurring or induced by human activities, on or within specific target icy bodies or classes of objects;
- The range of values that can be estimated for the above factors based on current knowledge, as well as an assessment of conservative values for the other specific factors that might be provided to missions targeting individual bodies or classes of objects; and
- Scientific investigations that could reduce the uncertainty in the above estimates and assessment, as well as technology developments that could facilitate implementation of planetary protection requirements and/or reduce the overall probability of contamination.

The committee's most basic conclusion is that it can not support the continued reliance on the Coleman-Sagan approach for estimating the probability of contaminating the icy bodies of the outer solar system. The Coleman-Sagan approach relies on the multiplication of multiple factors of uncertain magnitude that often lack statistical independence. The committee proposes that the Coleman-Sagan approach be replaced by a binary decision tree addressing seven factors that reflect the geologic and environmental conditions on the icy bodies of concern in the context of the metabolic and physiological diversity of terrestrial microorganisms.

The chair and vice chair of the committee, Dr. Mitchell L. Sogin of the Marine Biological Laboratory and Dr. Geoffrey Collins of Wheaton College, respectively, will conducted a detailed briefing on the report's conclusions and recommendations for members of your staff at NASA headquarters on 13 April. They and I stand ready to conduct additional briefings as they should prove necessary.

Yours sincerely,

A handwritten signature in black ink, appearing to read "David H. Smith". The signature is fluid and cursive, written over a light background.

David H. Smith
Study Director

Enclosures

cc: Marc Allen, NASA/SMD
Catharine A. Conley, NASA/SMD
Dolores Holland, NASA/SMD
James L. Green, NASA/SMD
Charles Kennel, NRC/SSB
Michael Moloney, NRC/SSB
Tiffany Neal, NASA / GSFC
Curt Niebur, NASA/SMD