



On Categorization of the Mars Orbiter Mission: Letter Report

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Committee on Planetary Biology and Chemical Evolution, Space Science Board,
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June 6, 1985

Arnauld E. Nicogossian, M.D.
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Washington, D.C. 20545

Dear Arnauld:

In response to your letter requesting advice on categorization of the Mars Orbiter Mission, from the point of view of planetary protection, the Committee on Planetary Biology and Chemical Evolution of the Space Science Board considered this issue at its latest meeting on May 15 and 16, 1985.

For its deliberations, the Committee solicited information and opinions from a number of specialists, all of whom are, or have been involved in studies related to this subject (I. Friedman, Fla. State Univ.; N. Horowitz, Cal Tech; R. Huguenin, University of Massachusetts; B. Jakosky, Colorado U; T. Jukes, UC Berkeley; P. Mazur, ORNL; and C. Sagan, Cornell). In addition, the Committee was briefed by personnel of the MO project, who presented an overview of the mission, with particular emphasis on the status of their planning efforts to meet NASA's planetary protection guidelines.

In arriving at a recommended Category for this mission, the Committee strongly reaffirms the position, taken by previous SSB committees, that Mars is the prime extraterrestrial target for the study of planetary biology and chemical evolution (cf.: Space Science Board, "Opportunities and Choices in Space Sciences, 1974," NAS 1975, Space Science Board, "Post-Viking Biological Investigations of Mars", NAS 1977). As a result of the Viking mission, it appears that the likelihood of an indigenous biota on Mars is very remote. Nonetheless, the limited scope of the Viking investigations leaves open the possibility that future studies may show this initial assessment to be incorrect. Viking also raised a myriad of, as yet, unanswered questions regarding the chemical and physical environment of that planet - questions such as the nature and distribution of the putative "oxidant" imputed to be present in the regolith, and whether liquid water and/or organic compounds exist at or near the surface of Mars in any regions of the planet.

The Committee is sensitive to the incompleteness of our understanding of the Martian environment — especially on the scale of "micro-environments" that might be adequate to sustain some potential terrestrial contaminants. Furthermore, we are mindful of the diversity and adaptive capabilities of terrestrial microorganisms (of which only a fraction has, as yet, been characterized!) These considerations, together with our strong desire to minimize the chances for ambiguity in future studies of Martian surface samples dictated a conservative approach as the most prudent course to follow in connection with the MO categorization.

Arnauld E. Nicogossian, M.D.
June 6, 1985

Accordingly, the Committee judges the MO mission to be properly assigned a Category III designation. We further recommend that the MO Project carry out all of the precautions that the Project personnel described as being necessary to meet the stringent requirements inherent in this category. These include: assembly of the spacecraft in Class 100K cleanrooms; biasing the injection aimpoint of the spacecraft to assure a probability of $<10^{-5}$ of impact of the launch vehicle, and a probability of $<10^{-4}$ of impact of the spacecraft; selecting a mapping orbit such that the probability of remaining in orbit until the year 2009 is >0.9999 ; and, raising the orbit of the spacecraft upon completion of the nominal mission to an orbit with a probability of >0.95 of remaining stable until the year 2039.

With regard to the prospects of implementing these requirements, the Committee is pleased to note the considerable effort that has already gone into these matters on the part of the MO Project. We therefore expect that meeting these planetary protection objectives will pose no insuperable problems for them.

Please note that the Project personnel expressed a sense of urgency, since their plans call for the "sign-off" on their final "Planetary Protection Plan" in September of this year.

Finally, the Committee expressed its willingness and interest to assist NASA in categorizing additional solar system missions. In these cases, it would seem most expedient to consider the issues involved for each proposed mission at an earlier stage than was done for the MO mission - that is, before concepts for the mission(s) become "hardened" and at a time when additional requirements are less likely to be burdensome.

Yours sincerely,

Harold P. Klein

Harold P. Klein, Chairman
Committee on Planetary Biology and
Chemical Evolution, SSB

cc: Dr. Tom Donahue, SSB