On the Venus Radar Mapper Mission: Letter Report

Committee on Planetary and Lunar Exploration, Space Science Board, Commission on Physical Sciences, Mathematics, and Resources, National Research Council

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NATIONAL RESEARCH COUNCIL
COMMISSION ON PHYSICAL SCIENCES, MATHEMATICS, AND RESOURCES
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3 December 1982

Mr. Jesse W. Moore (EL-4)
Director, Earth & Planetary Exploration
Division
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Washington, D.C. 20546

Dear Jesse:

The Committee on Planetary and Lunar Exploration (COMPLEX) in its strategy for the inner planets recommended "that the triad of terrestrial planets, earth, Venus, and Mars, should receive the major focus of exploration of the inner solar system for the next decade. The ultimate goal in this exploration is to understand the present state and evolution of terrestrial planets with atmospheres. The comparative planetology of these bodies is a key to the understanding of the earth, its atmospheres and oceans, and the physical and chemical conditions that lead to the origin and evolution of life." In reassessing the relative balance of our knowledge of this triad of planets following the achievements of the Pioneer-Venus mission and the recent Venera missions, we have concluded again that the nature of the surface of Venus remains the greatest unknown factor. Therefore, we can reaffirm that obtaining a global map of the topography and morphology of the surface of the planet at sufficient resolution to allow identification of the gross processes that have shaped its surface is of the highest importance per se and in the context of the inner planet strategy.

COMPLEX finds that the Venus Radar Mapper (VRM) mission, as described to the committee at its last meeting, will adequately address our first priority science objective for Venus (Strategy for Exploration of the Inner Planets: 1977-1987). It is the committee's understanding that both the images and the resulting topographic map will cover 90% of the surface at better than 1.5 km resolution, that the gravity map will cover 76% of the surface at 700 km resolution, and that the altimetry and gravimetry measurements will be accurate to 75 m and 5 milligals or better respectively.

The images obtained from the Pioneer-Venus orbiter have demonstrated the feasibility of synthetic aperture radar techniques to map the surface of Venus. As a result we are now able to identify the major physiographic features of the surface and, in a limited sense, to characterize global

physiographic provinces. However, the resolution obtained by the Pioneer-Venus orbiter was not sufficient to identify and characterize the surface processes that have created the present physiography. In this regard, the data and findings from higher resolution capability of VRM will build in a systematic and rational manner on the knowledge acquired from Pioneer-Venus.

As you will recall, the SSB and COMPLEX gave a similar endorsement to the Venus Orbiting Imaging Radar (VOIR) mission before the agency, because of fiscal restraints, was obliged to reduce the scope of this mission to the more modest level represented by the VRM. Because the first priority science objective in the strategy for Venus has been preserved in the VRM and because it will address adequately the associated measurement requirements, COMPLEX believes its endorsement of VOIR can also be applied to the VRM. The committee notes that the capability to acquire very high resolution of selected surface areas is now not possible with the VRM. It is our understanding that the JPL study team would be willing to consider and study alternatives to achieve this capability within the present cost magnitude. The committee requests that it be regularly advised of progress in this effort. Further, since the briefing of VRM to the committee, it now appears that the Centaur will replace the IUS as the agency's high energy upper stage. With this added capability, we wish to be kept apprised of any changes or new opportunities that may be considered for VRM. Lastly, there is a reasonable difference of opinion on selection of the Venus latitude for the VRM periapsis. In the present orbit configuration with periapsis at -10°, imagery will be obtained of the South Pole and the larger unmapped area in the Southern hemisphere; however, the resolution over Ishtar Terra will be inferior to Pioneer-Venus. Since Ishtar Terra may provide the key to characterizing the tectonics of Venus, there is merit in considering the case, and its effect, for moving the periapsis to $+30^{\circ}$ to $+40^{\circ}$. COMPLEX recommends that the scientific arguments for periapsis location should be given ample opportunity to resolve the issue, and requests that the committee be kept informed of its progress.

Finally, we would like to express our serious concern for the planetary program as reflected in the pacing of new starts and the shrinking level of support for data analysis and scientific study. Should the VRM be approved, it will be the first new start in the program since Galileo in 1977. In the opinion of the committee, a new-start for the planetary program

in FY84 must be accompanied by a sustaining baseline support for research and analysis mission operations and data analysis, including theory. Such an action is clearly required to maintain a healthy program, and it would be clearly perceived as a positive indication for the U.S. planetary program.

The committee would like to express its thanks for your effort in organizing the VRM review and requests that you extend our appreciation to the JPL study team and the members of the science working group.

We will be happy to discuss these issues further at your convenience.

Sincerely,

D. M. Hunten

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Chairman