

**Statement of
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before the

**Space Subcommittee of the Committee on Science, Space and Technology
U.S. House of Representatives**

Mr. Chairman and Members of the Committee, thank you for the opportunity to appear today. My name is Philip R. Christensen, and my title is Ed and Helen Korrick Professor of Geological Science at Arizona State University. I have actively participated for the past 35 years in a range of NASA planetary science missions. I recently chaired the Mars Panel of National Research Council's Planetary Decadal Survey and currently co-chair the Committee on Astrobiology and Planetary Science for the NRC. The views that I present today are my own, and do not represent the opinions of the National Research Council or any other organization.

Three themes run through my testimony today:

- Planetary science has excellent opportunities for continuing the exploration of our solar system into the future. These opportunities have been clearly defined in the recent NRC Planetary Science Decadal Survey, *Vision and Voyages in the Solar System* (National Academies Press, 2011), and they remain the same today.
- Significant reductions in the level of funding for NASA's Planetary Science Division from the previous decade have dramatically slowed the pace of new missions and future discoveries.
- The lack of year-to-year stability in funding is having a serious impact on the ability to develop a long-term plan for planetary exploration.

Planetary science and the Decadal Survey

The NASA planetary science program has made a remarkable series of discoveries over the past several decades that have dramatically changed our views of the solar system we live in. This program is poised to continue to make major discoveries based on the plan and architecture outlined in the NRC's Planetary Science Decadal Survey report. That report represented the consensus of the U. S. planetary science community that was reached through over two years of effort on the part of hundreds of scientists and engineers. The Decadal Survey clearly defined a program centered around a suite of missions of differing sizes that will explore the highest priority objects in our solar system. These missions include the highest priority objective - a Flagship mission to

begin the Mars sample return campaign by collecting and caching samples on the martian surface for return to Earth. The proposed suite of missions also includes a mission to explore Europa, a moon of Jupiter with a liquid water ocean beneath an icy crust, as well as a robust and balanced program of Discovery and New Frontiers missions. The report emphasized the importance of continued support for the research and analysis of the wealth of data returned from past missions, as well as the development of new technologies that will enable continued discovery into the future.

A key point of the Survey was its emphasis on program balance – the importance of a balanced suite of small-class Discovery, medium-class New Frontiers, and Flagship missions that will maintain the strength and world leadership of the planetary science and engineering communities. The Survey also stressed the importance of a balance of targets within the solar system, including Mars, the outer planets and their satellites, the inner terrestrial planets, and the diversity of comets and asteroids that are found throughout our solar system.

In the three years following the release of the Decadal Survey the key recommendations and scientific priorities remain essentially unchanged. The Decadal Survey continues to provide an excellent plan for planetary exploration. And the report continues to have the strong support of the planetary science community.

Challenges

The primary challenge that the planetary program has faced in implementing the Decadal Survey recommendations has been the significant reduction in planetary science funding that occurred after the report was completed. The detailed scientific rationales and plans laid out in the Decadal Survey were based on the continuation of planetary science funding at the level that had been provided during the previous 10 years. Almost immediately following the Report's release, the fiscal year 13 funding to planetary science was reduced by over 20% from the previous year – the cut to the Mars Program was 35% - and has remained at essentially this level in the President's budget proposed in the subsequent years. Not surprisingly this 20% reduction has had a dramatic effect on solar system exploration.

With the strong support of Congress the planetary science budget has been increased from the President's proposed budget in each of the past two years. Despite these increases, however, planetary science funding has remained well below the preceding years, and well below what is needed to implement the Decadal Survey recommendations.

Equally important, the uncertainties that exist in the year-to-year levels of support have made long-term planning extremely difficult. Planetary missions require many years, or even decades, to plan, develop, implement, and operate. As an example, the Voyager spacecraft now on the fringes of interstellar space were launched in 1977 and their planning and development began even earlier. Without stable funding it is very difficult to implement these long-term missions, with the result that missions are either not begun or

their development is extended, with a resultant increase in mission cost.

The reductions and uncertainties in planetary science funding that have occurred have resulted in significant slowing of the pace of new missions. These reductions also pose the threat of significant reductions in the scope of even the highest priority missions. And these reductions have placed stress on the programmatic and destination balance within planetary science – there simply hasn't been sufficient support to maintain the mix of mission sizes and destinations that had been the hallmark of NASA's planetary exploration program.

Where we are

In spite of these stresses, there have been major positive advances. In my view the key areas of progress, and concern, are the following:

- The highest priority Decadal recommendation - to begin the campaign to return samples from Mars - has been initiated with the approval of the Mars 2020 rover. This rover will carefully collect and cache a suite of high-quality samples to be returned to Earth by future missions. However, looking to the future, the planetary program needs to start now to begin developing the technologies required to return these samples. Without this development the return of these samples to Earth for study – which was the very element that made this mission the highest NRC priority – is in jeopardy of slipping well into the future. In addition, any increases in the development costs for Mars 2020 could threaten the capability of the caching system. In order to meet the goals laid out in the Decadal Survey, it is essential that Mars 2020 retain the capability to collect and cache a suite of high quality samples that will enable the extraordinary science payoff that will come when these samples are returned to Earth.
- Europa, the second highest Flagship recommendation in the Survey, has received support from Congress and NASA through the release of a request for proposals for science instruments that could be carried aboard a future mission. This is an important next step for exploring Europa. But it is only the beginning - the mission will require significant new funding to be implemented. In order to maintain balance within planetary science it is essential that the outer solar system remains a key part of NASA's portfolio. While the continued support for Europa from Congress and the Administration is very encouraging, it is important that the commitment be made to start this mission in earnest. Continued funding at levels below what are required to initiate the mission has the risk of adding to its overall cost.
- The planetary science Research and Analysis Program has managed to maintain a strong program during these times of rapid budget reduction. The research program is an essential part of the program, and in the past has been raided to make up shortfalls in the mission funding. This has not been the case in recent years.
- Perhaps the greatest difficulty that the planetary science program faces with the reduction in funding has been the delay in starting the next New Frontiers and

Discovery missions. These missions provide important opportunities for the planetary science community to follow up on new discoveries and pursue new directions. In many ways these missions provide lifeblood to the community by providing motivation and opportunities for early- and mid-career scientists and engineers. The selection process to identify the next Discovery mission is being initiated this year, but there are no plans to begin work on the next New Frontiers mission in the foreseeable future.

Human and Robotic Exploration of Mars

The Mars science program can, and should, play a major role in the long-term goal of sending humans to Mars. Much of the information that will be required to safely land and return humans from the martian surface is being obtained by the robotic program. The physical and chemical properties of the surface, the nature and state of the atmosphere, the occurrence of water and other critical resources, are all areas of intense investigation by the Mars science program. In addition, the robotic science program can make significant progress on several of the key technological and programmatic issues that human missions will eventually face, such as issues of how to land on and leave the martian surface, how to utilize the resources available on Mars, and how to deal with planetary protection and radiation hazards. All of these can be addressed by the ongoing scientific study of Mars and a robotic campaign to return samples from the surface.

Summary

In summary, planetary science and exploration have virtually unlimited opportunities. These opportunities have been thoughtfully outlined in the NRC's Planetary Science Decadal Survey, and the priorities described in that plan remain the same today. The current level of reduced funding, and the year-to-year uncertainties in that funding, have slowed the pace of new missions, but the U.S. planetary scientists and engineers remain engaged and committed to a balanced program of solar system exploration. Mars and Europa provide amazing opportunities for major discoveries regarding the possibility of habitable worlds in our solar system. NASA needs to remain focused on these highest priority targets, and remain on the path to return samples from Mars and to send a highly capable mission to explore Europa.