TESTIMONY TO THE COMMITTEE

ON

SCIENCE, SPACE AND TECHNOLOGY

SUBCOMMITTEE ON SPACE

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Chairman Babin and Committee members, I am pleased to have the opportunity to present my views on NASA: Past, Present and Future. My testimony is focused on NASA's science and human spaceflight programs. I do not mean to diminish the role NASA has played and continues to play in advancing aeronautics research which is very important to our country.

NASA's accomplishments during the six decades of its existence have been extraordinary. It is hard to imagine a public or private sector organization that has accomplished more, given the level of difficulty of the NASA endeavors. Included in the array of accomplishments are observations that have revolutionized our understanding of our sun and planetary home, landers and rovers on the surface of Mars, robotic visits to all of the planets of our solar system, telescopes that have looked billions of years back in time and also have discovered hundreds of planets around other stars, humans walking on the surface of the moon, and the development and operation of a space station that is a technological marvel.

Truly NASA has repeatedly turned the perceived impossible into reality. NASA's accomplishments have filled our books and electronic systems with new knowledge about our sun, earth, our solar system, the universe and humans operating in space. NASA has been a source of enormous national pride and international prestige. NASA has inspired our youth as well as people of all ages. When we make the observation that "Great Nations Do Great Things," the NASA contributions are high on the list of great things. NASA has done its part in making our nation great.

One of the more impressive accomplishments of NASA has been the human exploration program, specifically humans walking and riding on the surface of the moon while exploring and enhancing our scientific understanding of our nearest neighbor. Returned lunar samples are still yielding new data even after more than four decades. While the lunar endeavor was spectacular, it also highlights a disappointment that no "boots on the ground" human exploration venture has been accomplished since Apollo 17, 44 years ago. We have the opportunity to rectify this disappointment in the next couple of decades.

The enormous capability that has been developed from the multitude of successes, as well as disappointing failures, is often overlooked when assessing the accomplishments of the last six decades. NASA has an enormous bank of knowledge, experience and expertise, largely resident in the people of NASA.

It would be wrong to equate the accomplishments of the last six decades to NASA alone. The U. S. aerospace industry with implementation capabilities second to none has been an incredible partner. The industry has continued to develop its capabilities to implement the most challenging of endeavors. The third leg of this national capability is the depth of talent that resides in our laboratories and academic institutions.

I believe the reason for the remarkable success of the last six decades is that we have fully utilized the continuity of expertise resident in NASA in combination with the implementation capability of industry and the talent and capabilities in our laboratories and academia. Space is a "one strike and you are out" business and it takes the absolute best of all sectors to assure success. Our space initiatives

are focused on exploration and science. To maximize our exploration and scientific results also requires our absolute best. These lessons learned will be critically important to the future NASA.

Where is NASA today? The trend of challenging endeavors with anticipated incredible results continues unabated. The James Webb Space Telescope, SLS, Mars 2020 as the first step in returning samples from the surface of Mars to earth and Orion are but examples.

In addition to rigorously implementing the approved NASA program, a most important responsibility is developing a strategy for the future. This is currently critical because the challenges and opportunities are large and significant. With exceptional leadership, focus, commitment and support the future can be even more rewarding than the past six decades. It is also possible that we can spend a lot of money and human capital and accomplish little.

There is a set of great questions that can guide our thinking about the future.

* Are we alone?

* What is dark energy and dark matter?

* Is it possible and practical for Mars to be a lifeboat or a second home for the human race?

There are certainly other great questions, but these are appropriate to start the discussion. I believe we can answer each of these questions in the next few decades. I suspect we have all looked at the night sky and wondered if we are alone or do we have neighbors waiting to be discovered. The fact that we don't understand approximately 90% of

the universe says the opportunity for awesome discoveries awaits us. I suspect we all have enormous faith in the human race on earth; however, my space project training says one should always have a contingency plan for a potential catastrophe. If we want a second opinion we should check with the dinosaurs. Mars appears to be the only potential alternative.

In discussing the NASA future, I will separate my comments into science and human spaceflight. The science element is well planned and focused upon the highest priority endeavors. The National Academies decadal surveys are well done with broad participation of the scientific community. NASA effectively utilizes the decadal surveys to establish direction for the science enterprise.

A simple check on the quality of any endeavor is the merit of activities that are beyond the funding limits of the endeavor and not being pursued. For science the programs just beyond the funding barrier are of equal quality to those being funded. The conclusion of this simple test is that additional funding would allow the inclusion of equally high value opportunities and enhance the value of the overall portfolio.

The current and future strategic state of human spaceflight is cloudy. In current NASA budgets, approximately 9B$ is allocated to human spaceflight. Over the next two decades that accumulates to approximately 180B$ which should support significant accomplishments. My view is that there are too many potential paths competing for the available resources making it imperative that difficult program decisions be made. About half of the current budget is allocated to Low Earth Orbit (LEO) endeavors which consist of the

International Space Station, commercial cargo and commercial crew. The other half of the budget is for human exploration which includes SLS and Orion. A 4.5B$ annual budget is clearly inadequate for a credible human exploration program. A choice must be made and made soon between LEO and exploration. Additionally, there is discussion of NASA leading or being the catalyst for commercializing LEO. There are also plans for a sislunar space endeavor of approximately a decade duration. Debate continues as to whether the moon or Mars should be the exploration objective.

Are we going to have a credible human exploration program? Assuming the answer is yes, we need to focus our fiscal and human resources on making exploration a credible reality. Failure to decide between these competing options will result in spending significant resources and not having a credible exploration program.

My personal conviction is the primary human spaceflight goal for the future NASA should be exploration with "boots on the ground" on either the moon or Mars. I believe Mars is the most compelling objective. I believe the commercialization of LEO should be the responsibility of the private sector with NASA providing technological support but not management or financial support. Above all else a detailed plan for the human exploration program is mandatory.

A future NASA focused upon the great questions with a science portfolio guided by the National Academies decadal surveys and a human spaceflight program concentrating on the human exploration of Mars, can be responsive to the axiom that " Great Nations Do Great Things." NASA's future can be even more exciting and rewarding than NASA's extraordinary past.