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Statement of
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Aerospace Safety and Advisory Panel

Before the

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

Chairwoman Horn and Members of the Subcommittee, thank you for the opportunity to appear before you today to discuss NASA's deep space exploration programs, including proposed lunar activities.

As you know, the Panel I chair is charged with advising both the NASA Administrator and the Congress with respect to the safety and risk of human space flight among other aspects of safety. In opening, I would like to emphasize that the Panel feels the responsibility to provide advice in such a way as to promote driving down risk to the lowest reasonable level consistent with accomplishing the mission. Space exploration is inherently dangerous. The environment is hostile and the systems needed to survive in it are complex. Our charge is not to avoid that risk at all costs, but to manage that risk intelligently.

Our advice and recommendations over the years has included some consistent themes:

- A key one, repeated year after year, is the importance of setting challenging, but achievable schedules and not allowing undue schedule pressure to lead to decisions that adversely impact safety and mission assurance.

- Secondly, is that the question of "how safe is safe enough" cannot be addressed without consideration of the overall risk-benefit equation.

- Thirdly, we have consistently maintained that mission success requires a constancy of purpose, a sustained commitment and a clear understanding of objectives.

- And, we have continuously maintained that while NASA should never lose sight of the fundamentals in risk management for successful program execution, there is no one approach that dictates that success and there should be an openness to learning and accepting alternative means to understand and control margins.

I will speak briefly to each of these principles in the context of the current programs, including proposed lunar activities and the long-term goal of sending humans to the surface of Mars.

The Administration has announced that its stated policy, and that of the United States, is to return astronauts to the Moon within the next five years. This declaration has added an urgency and vibrancy to an already complex and ambitious endeavor. But as NASA prepares to meet this exciting, but clearly aggressive goal, our Panel continues to caution that targeted launch dates, while useful to impart a sense of urgency and to convey the importance of holding to the planned schedule, should be used judiciously. It can be detrimental to employee morale if the official dates are clearly not achievable, given the work that needs to be accomplished. Unrealistic schedules can also result in poor decisions, at least from a safety perspective, if meeting these deadlines results in imprudent shortcuts, or elimination of important testing.

For example, the Panel has been aware that NASA has been exploring options for launching Exploration Mission One (EM-1) as early as possible. This examination will no doubt result in some useful approaches – perhaps achieving greater decision velocity, restructured and more efficient work flow, and a more streamlined approach. But as plans go forward for EM-1, we should not lose sight of the fact that the ultimate objective of that flight is to mitigate risk and understand the operational margins prior to the first crewed flight. There are several critical data sets that are required to ensure, as much as possible, a safe EM-2 mission, such as a successful Green Run, an effective heat shield, effective operation of the parachute systems, the abort mechanisms, and the environmental control and life support functions among others.

In addressing safety in human space exploration, balancing the risk value proposition is critical. NASA's role in leading the advancement of space technology involves pushing the envelope on technology development and human exploration. In seeking the benefits of these endeavors, there are immense uncertainties and inherent risks. "Safe" as a term used in the context of large-scale, technically complex space systems and operations in the hazardous space environment, does not have the same connotation as the word in typical, day-to-day life. While there is no excuse for negligence, it is impossible to control, eliminate, or mitigate every risk. But determining the level of risk that is acceptable is far from straightforward and is not a classical scientific decision. The risk tolerance decision requires balancing many factors such as financial cost, schedule, national prestige, international relationships, human welfare, public opinion, and ethical considerations, to determine if the chance of a mishap is outweighed by the likely mission benefit.

Applying this to any plan to return astronauts to the Moon in the near term, the risk value proposition needs to carefully weigh the objectives of such a plan and its execution. Return to the Moon should not be an end in itself, but part of a larger strategy. One should ask what is the purpose of the mission? Is it structured as part of a cohesive, long-term strategy? Will the plan buy down risk for further exploration? Will the approach apply resources in such a way that there is residual infrastructure that enables next steps? Does it further a potential national goal of promoting a commercial space self-sufficiency? Does it support the nation's leadership in space and foster international cooperation? Great exploration has always included major risk – whether it was Magellan or Lewis and Clark – but it has been undertaken with an expectation of substantial benefit. Clearly articulated goals, and candid communication of the accepted risks are critical to sound leadership and decision-making.

Going hand-in-hand with the risk value proposition and a recurring theme for the Panel is Constancy of Purpose – a national steadfastness in pursuing articulated goals that does not waver over time and a willingness to support those goals with the necessary resources. Regardless of how NASA tackles the technical challenges, fluctuating policy goals, ambiguous objectives, budget inadequacies and uncertainties – including partial and full year Continuing Resolutions -- add complexity to program management and inefficiency to execution, detracting from the ability to achieve the technical goals with the requisite focus on safety and mission assurance. The consequence of not sustaining a clear and constant purpose include program resets, associated delays in achieving goals, extended schedules, and, inevitably, increased risk.

Lastly, as NASA embarks on this next phase of deep space exploration, I encourage them in partnership with the Congress, to hold fast to the foundational standards of risk management while embracing new approaches. Hang on to the fundamentals of identifying the performance margins of their developing systems, understanding those margins and controlling operations within those margins. But do not fear alternative approaches to achieving those fundamentals.

For example, in considering the schedule for a critical flight test like EM-1, there is a critical judgment that should be made. On one hand, there is a conservative approach that argues for not flying the test until all components have been qualified, all subsystems have been completed, and there is reasonable assurance that the flight test is performed with the anticipated final configuration. This is a traditional approach, essentially performing a “dress rehearsal.” An alternative could be to launch a flight test sooner in order to obtain data on integrated performance earlier in order to inform design considerations on the final configuration. Early integrated test data can advise final design decisions, but runs the risk of potentially significant differences between the test and final articles. Both approaches have merit and determining the path to employ takes a deliberate, detailed and important dialog on the risk tradeoffs for the overall program.

In that vein, NASA can learn from, and expand on, the lessons learned in the Commercial Crew Program. What developed over time in that experience – establishment of mutual trust and transparency, the employment of “badgeless teams”, and the early engagement of the government – along with appropriate contract flexibility and timely decision making have the potential to not only lower costs and shorten development times, but also to reduce risk.

In closing, I will note that NASA and the nation have made significant progress in the last few years with the Exploration Systems Development Program, but much work lies ahead. This is a time for both excitement, optimism and reasoned caution.

Thank you. I look forward to your questions.

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- Independent Aerospace Consultant
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Dr. Patricia Sanders is now an independent aerospace consultant after having been a Senior Executive with the Department of Defense (DOD) and retiring from the Federal Government after 34 years of service with experience in the management of complex technical programs, leadership of large and diverse organizations, and development and execution of policy at the DOD level.

Dr. Sanders retired from Government service in 2008 as the Executive Director of the Missile Defense Agency (MDA). She was the senior civilian in the Agency responsible for its management and operations, safety and quality control, strategic planning, legislative affairs, external communication, and all issues related to worldwide personnel administration and development. Previously, she had been the System Executive Officer and Deputy Director for Integration of MDA, managing program content, schedule, cost, and technical performance for the Agency's $9 billion per year program of work.

After teaching for Boise State University and the University of Utah, Dr. Sanders began her national security career with the U.S. Army in Germany in 1974. She progressed through a number of challenging positions including management of several Defense acquisition programs; positions with the Air Force Operational Test Center in space system and aircraft avionics testing; Chief Scientist for the Command, Control, and Communications Countermeasures Joint Test Force; and Director of Analysis for the U.S. Space Command.

In 1989, Dr. Sanders moved to the National Capital Area to assume the first of a number of staff positions within the Office of the Secretary of Defense, culminating with service as the Director of Test, Systems Engineering, and Evaluation. She joined the missile defense community in 1998 and participated in the establishment of the MDA, was responsible for creating its robust test organization, initiated the Sensors Directorate, and accomplished pioneering work in managing integration of the Ballistic Missile Defense System.

Dr. Sanders has actively supported professional, academic, and civic organizations, serving on numerous executive boards. She is a Fellow of the American Institute of Aeronautics and Astronautics and has received three Presidential Rank Awards for executive achievements. She was awarded the Allen R. Matthews Award for significant accomplishments in test and evaluation and the AIAA DeFlorez Award for Modeling and Simulation, which recognizes achievements in its aerospace applications.