TESTIMONY TO THE COMMITTEE

ON

SCIENCE, SPACE AND TECHNOLOGY

SUBCOMMITTEE ON SPACE

FEBRUARY 3, 2016

A. THOMAS YOUNG

Chairman Babin, Ranking Member Edwards and Committee members, I am pleased to have the opportunity to present my views on the U. S. human spaceflight program. While I am a member of the NASA Advisory Council, my participation in the hearing today is as an individual representing only myself.

The U. S. human spaceflight program from Alan Shepherd's initial suborbital flight and John Glen's orbital flight to today's International Space Station (ISS) has been rich in exploration excitement, scientific return and technological accomplishments.

The success of the human spaceflight program for over five decades can be traced to many factors. Clearly the integration of the extraordinary NASA capabilities with the exceptional implementation capabilities of industry has been a major factor. NASA alone or industry alone could not have been successful. This is an important lesson as we plan for the future.

Today the future of the human spaceflight program is far from clear. We know some critical parts of the puzzle , including the ISS, Commercial Cargo, Commercial Crew, SLS and Orion. There are many pieces that are yet to be defined and funded. These include a habitat module, landing systems,

a solar electric propulsion tug and a launch system for return from the surface of the moon or Mars.

We have continual debate as to whether our goal should be the moon, Mars or both.

We have a FY 2016 budget that allocates approximately 9B$ for human spaceflight. The budget is divided roughly equal between LEO and exploration.

What we do not have is a plan, strategy, or architecture with sufficient detail that takes us from today to humans on the surface of Mars or the moon with a long term goal of extended presence.

I would like to offer my views on the existing and missing pieces of the puzzle. Starting with the budget , if the FY 2016 amount of 9B$ remains constant with the addition of inflation for the next two decades there will be approximately 180B$ with today's buying power available. With that level of funding, significant progress can be made on a human exploration program. A study to define a minimal architecture for human journeys to Mars initiated by Scott Hubbard and conducted at the Jet Propulsion Laboratory provides a credible argument that a Mars mission is feasible at these funding levels. I believe Increases in the budget can be expected to support a comprehensive program that includes appropriate precursor activities and missions. To realize a responsible funding level

for exploration will require critical decisions as to the activities in Low Earth Orbit (LEO) and a well defined, highly focused plan that includes only those activities necessary for the success of the endeavor.

Currently the human spaceflight budget supports both a LEO program consisting of ISS, Commercial Cargo and Commercial Crew and an exploration program consisting of SLS, Orion and other exploration activities. Future budgets will be required to support the additional required pieces of the puzzle discussed earlier. The combination of the current LEO program and the desired exploration program are not affordable at current budget levels. A choice is required between the two programs. A sustainable exploration program requires that the necessary knowledge from ISS be obtained expeditiously followed by diverting current ISS funds to exploration. An alternative is to continue funding the LEO program and forgo a credible moon or Mars exploration program that results in humans on the surface within a reasonable schedule and budget. We cannot do both without a major augmentation of the budget.

NASA has done an excellent job of maintaining a conservative cargo transportation capability. This conservative approach allows a mission failure or multiple failures to occur without catastrophic consequences. It also allows a

management approach that relies heavily on the commercial partner with modest NASA involvement.

Commercial Crew is much more challenging. A Commercial Crew failure that involves loss of the crew will be a catastrophe. This recognition requires Commercial Crew to be managed significantly differently than Cargo. Commercial Crew requires the full application of the NASA human spaceflight expertise in combination with the extraordinary implementation capability of industry to assure an acceptable probability of success. The concept often stated to let the "commercial world" be responsible for LEO activities with NASA responsible for exploration is not valid for Commercial Crew.

If the emphasis is to be on exploration as opposed to ISS, it seems prudent to reexamine the economics to NASA of Commercial Crew. A counter argument is that a vibrant commercial enterprise will emerge in LEO after NASA "leaves." Hopefully, this is true. I am not convinced; however, if the commercial sector believes this to be true and a good investment, than it should be funded by the commercial sector and not at the expense of the exploration program.

The next topic I would like to address is the moon-Mars debate. Each option has merit. While a human to the moon program is highly challenging, a human to Mars program is much more difficult, challenging and costly. This later factor

must be taken into consideration in the debate. My opinion is that Mars is a much more compelling option. I believe NASA, the current Administration and the House in the NASA Authorization Act of 2014 and 2015 have settled upon the human to Mars option. It is clear that we cannot do both and there is a need to focus all attention, capabilities and resources upon one option. For the remainder of my comments, I assume the humans to the surface of Mars option to be the choice.

The next subject addresses a critical missing piece of the puzzle. There is no obvious plan, strategy or architecture in significant detail for the future exploration program. I use the terms plan, strategy or architecture because the choice of the words in themselves seem to be polarizing. I am going to use the most general term, plan.

In my view a plan is required for the following reasons and must contain sufficient detail to accomplish the objective stated in each reason.

1) A plan is required for the implementation team to have a common focus.

2) A plan is necessary to obtain program support. Without a plan, constituents cannot make an evaluation and know if they are supportive.

3) A new administration will be in place in about a year. Without a plan it will be difficult to obtain support and avoid another redo of the content and focus of the U. S. human spaceflight program.

4) A plan is necessary to effectively define required technologies, including the level and schedule.

5) A plan is necessary to effectively define supporting information needed from ISS and the NASA science program.

6) A plan is necessary to identify the approximate level of required resources.

7) A plan is necessary to assure resources are applied in the most effective manner.

8) A plan is necessary to define precursor missions that should be planned and implemented.

9) A plan is necessary to define the cislunar space/proving ground activity that is currently evolving. It is important to do what is required for a successful exploration program and not what is possible.

10) A plan is necessary to effectively assess risk and develop mitigation plans.

An argument against a plan at the current time is that we are not ready to finalize the necessary elements of the plan. I

believe a strength of NASA program management is to establish a plan relatively early with the recognition that as new information becomes available, the plan can be changed.

I believe we have an opportunity to set a direction for the U. S. human exploration program that is exciting, realistic, inspiring and sustainable. I believe the most compelling case is for the humans to the surface of mars option.

Decisions are required relative to LEO if a vigorous exploration program is to be pursued This includes the future of ISS and Commercial Crew.

Preparation is required for the transition to the new administration. A plan in sufficient detail to maximize the probability of support and sustainability is required.

Above all else, a plan with significant detail that takes us from today to humans on the surface of Mars is required.

Thank you.