Testimony
of
Dr. Raymond S. Colladay

Strengthening NASA's Technology Development Programs
before the
Subcommittee on Space and Aeronautics
of the House Committee on Science and Technology

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Madam Chairwoman and members of the Subcommittee, I am pleased to appear before you today. My name is Ray Colladay and the personal views I express are shaped by my 40 years of experience in aerospace, through positions I have held in government, industry, and academia. I chair the Aeronautics and Space Engineering Board (ASEB) of the National Research Council (NRC) and also served as Vice Chair of the Academy funded study on "AMERICA'S FUTURE IN SPACE: ALIGNING THE CIVIL SPACE PROGRAM WITH NATIONAL NEEDS". Although I have insights into NASA acquired through those and other positions, my views are my own and do not represent an official position of the NRC.

With your permission, I would like to submit my prepared testimony for the record and summarize my views for you here this morning.

In the previously mentioned NRC report on "America's Future In Space", we observed that space has become ubiquitous and permeates nearly every aspect of our daily lives. We concluded that if properly aligned and coordinated, U.S. civil space can provide technological, economic, and societal benefits that contribute to solutions to the nation's most pressing problems. The study detailed seven recommendations for U.S. leadership in space, but among the most actionable of those recommendations—one that we called "foundational" in the sense that it was among those that enabled other goals and recommendations to be met—was that NASA needs to revitalize its advanced technology development program as a priority mission area in the agency.

Because of budget pressures and institutional priorities, however, NASA has largely abandoned its role in supporting the broad portfolio of civil space

applications, and the space technology base has thus been allowed to erode and is now deficient. The former NASA advanced technology development program no longer exists. Most of what remained was moved to the Constellation Program and has become oriented largely to risk reduction supporting the ongoing internal development program. Elements of that former advanced technology R&D focused on space science missions—primarily advanced instrument development—was also moved. Although it continues under the science mission directorate, and good work is being done, there is no longer the broader mandate to enhance the technology base and explore breakthrough technology that could possibly transform future science missions by influencing future requirements instead of simply responding to those already established.

The NRC report observed that future U.S. leadership in space requires a foundation of sustained technology advances that can enable the development of more capable, reliable, and lower-cost spacecraft and launch vehicles to achieve space program goals. A strong advanced technology development foundation is needed also to enhance technology readiness of new missions, mitigate their technological risks, improve the quality of cost estimates, and thereby contribute to better overall mission cost management. Space research and development efforts can take advantage of advances from other fields—and can contribute back to those fields. For example, civil space programs can benefit from and contribute to the state of the art in advanced materials, computational design and modeling, batteries and other energy storage devices, fuel-cell and compact nuclear power systems, fault-tolerant electronics and software, optics, and robotics. This scientific synergy extends the ability to accomplish more capable and dramatic missions in space, as well as to contribute to broader national interests driving innovation in other areas of terrestrial application. The unique challenges of the space environment make demands on technology in ways that often accelerate the development pace and advance understanding of the foundations of technologies. The responsibility to provide for this advanced technology base for civil space activities rests with NASA, in partnership with universities, other government agencies, and industry. The "customers" for the products of technology are NASA, NOAA, industry, and military space programs in which multiple-use technology is applicable.

To fulfill NASA's broader mandate, the study concluded that an independent advanced technology development effort is required, much like that accomplished by DARPA in the DOD, focused not so much on technology

that today's program managers require, but on what future program managers would wish they could have if they knew they needed it, or would want if they knew they could have it. This effort should engage the best science and engineering talent in the country wherever it resides in universities, industry, NASA centers, or other government laboratories independent of pressures to sustain competency at the NASA centers. A DARPA-like organization established within NASA should report to NASA's Administrator, be independent of ongoing NASA development programs, and focus on supporting the broad civil space portfolio through the competitive funding of world-class technology and innovation projects at universities, industry, federally-funded research and development centers, government research laboratories, and NASA centers. The responsibilities of the organization should be similar to those of NASA's aeronautics research in the sense that the research activities should be supportive of the needs of the private sector as well as the government—a mission well understood and supported by NASA going back to its predecessor, NACA.

Establishing an independent organization focused on broadly enhancing the technology base for civil and commercial space does not mean the development programs and operational mission areas of NASA do not need their own technology research and development resources to mature technology ready for transition and for risk reduction. Furthermore, a technology management process is needed that draws the interests of all stakeholders to common ground to assure the investment in technology is relevant to the needs of the eventual users and that a plan exists for its transition. This process creates a healthy tension between technology push and user pull.

The DARPA-like reference is not to be taken too literally, since what works well in the Department of Defense needs to be adapted to the NASA culture. But the reason for the reference is to address the need for an advanced technology mission to be given priority, be organizationally independent, be authorized to pursue technical excellence and research quality wherever it resides relieved of NASA institutional requirements, and be encouraged to promote and sponsor transformational, game-changing innovation that is not necessarily formally tied to existing, well-defined requirements.

The country expects NASA to be a leader pushing the frontiers of air and space applications and missions as called for in the Space Act. But to do so, they need to replenish the underpinning technology that makes it possible. I

believe it is time to make technology research and development an explicit priority as part of the agency's broader mission.

Thank you. That completes my prepared remarks and I would be pleased to take questions you may have.

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BIO:

RAYMOND S. COLLADAY is a retired corporate officer of the Lockheed Martin Corporation and the former President of the Lockheed Martin Astronautics company in Denver. Before entering the private sector, he held positions of Director of DARPA – the Defense Advanced Research Projects Agency of the U.S. Department of Defense and was Associate Administrator of NASA where he had senior executive responsibility for the agency's aeronautics and space research and technology development including operations oversight of Ames, Langley, Dryden, and Glenn Research Centers. Dr. Colladay started his aerospace career at NASA Glenn Research Center in propulsion R&D before moving to NASA Headquarters where he held a number of leadership positions before being appointed Associate Administrator of the Office of Aeronautics and Space Technology. He has been a member of the Air Force Scientific Advisory Board and various Defense Science Board summer studies. Currently, he owns an aerospace consulting company, RC Space Enterprises, Inc.; teaches leadership and ethics for the Colorado School of Mines; and serves on a number of boards, steering committees, and commissions. He received his BS, MS, and PhD degrees in mechanical engineering from Michigan State University and attended the Harvard Business School's Advanced Management Program. He is a fellow of the AIAA and of the American Astronautical Society. Dr. Colladay is Chairman of the Aeronautics and Space Engineering Board (ASEB) of the National Academies. He has two daughters and four grandchildren and resides in Golden, Colorado with his wife of 44 years.