Record Testimony

Prepared for Committee on Science and Technology
U.S. House of Representatives

Dec. 10, 2009

A. Thomas Young

Chairman Gordon and Mr. Hall,

It is a privilege to appear before this distinguished committee to present my views on the importance of our aerospace workforce to the United States.

Spaceflight in general and specifically human spaceflight is one of the more challenging endeavors of our time. It is truly the domain of rocket scientists. However, successful spaceflight requires much more than an expertise in rocket science. Intellectual capability is clearly necessary; however, without significant experience and continuity of participation, the intellectual capability is far from sufficient.

Why isn't intellectual expertise adequate? Why is experience and continuity of participation so critical? Spaceflight is a "one strike and you are out" business. Hundreds and for large projects, thousands of people can do everything correctly and one individual can make one mistake that can be mission catastrophic. While eliminating human error is a necessary aspect of successful spaceflight, we must recognize that human error cannot be totally eliminated and that human mistakes will occur.

There are not many endeavors that are characterized as "one strike and you are out." For most activities a significant error can occur, be recognized and corrected without major consequences. Some correlative spaceflight with commercial aircraft operations. I do not want to minimize the challenges of commercial aviation; however, airplanes land safely every day with significant problems. An option that is not available in the world of spaceflight.

Decades of experience and the dedication of extraordinary people who have made spaceflight their career has resulted in a way of doing business that greatly minimizes the probability of human error having a catastrophic result. It is the foundation of the extraordinary successes of the space program.

A “safety net” is required to prevent human error from becoming catastrophic. Testing, independent validation and inspection are elements of the “safety net.” If we test as we fly and fly as we tested, we will find and eliminate most problems. For some areas, such as software, a full test program is unrealistic requiring the use of an independent validation approach. In some special circumstances, such as the installation of a solid rocket motor, only inspection can provide the necessary “safety net.” It is the disciplined implementation of the “safety net” without compromise that is a foundation of missile success. A slight deviation from this disciplined approach can be the most damaging of human errors.

Unfortunately, failure reports any populated with deviations with names such as faster-better-cheaper, acquisition reform, we must take more risk, commercial practice, etc. Why do we accept these deviations which I will call “miracle” solutions. Many are the result of trying to put ten pounds into a five pound bag. Others are in responses to the criticism that we are too conservative and need to take more risk and others are associated with the premise that commercial practices are better. While there is some merit to each of these “miracle” solutions and we should constantly be responsive to better ways of doing business, most have been toxic to a “one strike and you are out” enterprise.

I would like to offer a few examples. Mars ’98 consisted of an orbiter, lander and two probes --- all failed. Mars ’98 was a faster-better-cheaper program with an inadequate budget. Risks were accepted in the absence of sufficient funding resulting in catastrophic failure.

A Titan IV with an important and expensive national security payload failed. Cause of the failure was a human error in documenting a number which resulted in failure. This failure occurred in an era of “acquisition reform” where emphasis was shifted from mission success to cost. The cost focus resulted in eliminating aspects of the “safety net” that would have most likely caught the error and eliminated the failure.

In the 1990’s, during the epoch of faster-better-cheaper, acquisition reform, take more risk, commercial practices, etc., the Aerospace Corp. documented 11B$ of mission failures.

My purpose has been to highlight the unforgiving nature of spaceflight, the need for uncompromising discipline and to recognize that it is a “one strike and you are out” business. I have also tried to emphasize that spaceflight is not a typical technological activity. Because of the special characteristics of spaceflight., a workforce is required that has the culture and capabilities aligned with these characteristics. A workforce with the necessary intellectual strengths and possibly even more important, the experience and longevity to establish the sensitivity as to what is required for spaceflight success.

Today in government, universities and industry we have such a workforce. It has evolved over decades of extraordinary successes and tragic failures. Exceptional men and women have

invested their professional careers and the United States has invested significant resources to achieve the spaceflight workforce we have today. It is truly a national treasure. Without a challenging and meaningful space program, this national capability will atrophy. It can only be maintained by inspiring use. It has a limited shelf life. As we debate the future of our space program, we must do so recognizing the importance of our spaceflight workforce and the role it will play in the success or failure of the space program of the future. Without proper attention and recognition of its importance, we could make changes that destroy what we have carefully built. I do not suggest change is to be avoided. I do suggest careful thought is necessary. A fundamental rule when debating change is “do no harm.”

A. Thomas Young

A. Thomas Young is the former Director of NASA's Goddard Space Flight Center and President and Chief Operating Officer of Martin Marietta. He retired from Lockheed Martin in July 1995. He is currently a Director of Goodrich Corporation and Science and Applications International Corporation. Mr. Young is involved in various advisory and review activities associated with the U.S. Space Program.

Mr. Young has chaired numerous review panels and study groups including: the Mars Program Independent Assessment Team, the International Space Station Management and Cost Task Force, the Joint Task Force on Acquisition of National Security Space Programs and the Independent Assessment Panel on the Organization and Management of National Security Space.

Mr. Young graduated from the University of Virginia with bachelor degrees in aeronautical and mechanical engineering. He holds a master of management degree from the Massachusetts Institute of Technology, which he attended as a Sloan Fellow. Mr. Young is a member of the National Academy of Engineering.