

Statement By

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**Chair of Committee on the Future
of the U.S. Space Program (1990)**

**Committee on Science
United States House of Representatives**

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Mr. Chairman and Members of the Committee, thank you for the invitation to appear before you today. I am pleased that you are taking this opportunity to examine America's space program and hope that a plan can be created which will endure over time and in which all Americans can take pride.

Before making my statement I should, in the spirit of full disclosure, call to your attention that I am a retiree and Board Member of the Lockheed Martin Corporation, a former President of the American Institute of Aeronautics and Astronautics, a former director of The Planetary Society and a former chairman of the Aerospace Industry Association.

I have been asked to address the findings of the Committee on the Future of the U.S. Space Program, a committee which was established approximately fourteen years ago by then-President Bush. I will briefly summarize what I believe were some of our

more significant findings and recommendations and, as you have requested, close with a few brief observations of my own.

It goes without saying that a great deal has changed since the commission which I chaired conducted its work. Today there is no Soviet Union dedicating substantial resources to maintain its own dynamic space program—and thereby providing a competitive impetus to America’s space program. In fact, rather than the Soviets and the U.S. being adversaries in space, the company I recently had the privilege of serving is now a partner in launching commercial spacecraft with those same Soviet enterprises that conducted the USSR space program of an earlier era—a notion that would have been unimaginable during the period preceding our committee’s deliberations.

And there have been other significant changes which have impacted America’s space program during the period which has intervened. For example,

- China is emerging as a major space participant, having recently taken particularly significant steps toward full membership in the space community.
- The United States has not realized the ten percent annual growth in the NASA budget that was forecast by virtually all senior officials in both the Executive Branch and the Congress at the time our commission commenced its work. In fact, NASA's budget, although still significant, has diminished in real terms.
- The commercial space business, (constructing and launching spacecraft) which seemed to hold such great promise a decade ago has largely been reduced to a commodity market and as such has, from an economic standpoint at least, been a disappointment.

- America's space industrial base has shrunk from a number of relatively healthy aerospace companies to a very few firms still maintaining strong space credentials . . . this being largely a consequence of the restructuring of the aerospace industry which occurred when defense spending dropped precipitously following the end of the Cold War.
- And there still seems to be no broad consensus as to what America's long-term space program should comprise.

On the other hand, a great deal has not changed. For example,

- Today we meet, as did our committee, in the wake of a failure of the Space Shuttle . . . in our case, the Challenger.

- There continues to be strong grassroots support for a space program, however, the transformation of that interest into budgetary measures has not been evident.
- There remain severe competing and legitimate pressures for federal funds . . . with the need to counter terrorism supplanting certain of the demands of the Cold War.
- The number of U.S. citizens studying engineering has continued to decline, even in the midst of the greatest technological explosion in history—an explosion which is growing our economy and modifying our lifestyle at a pace never before witnessed. Meanwhile, the scientific and technological capacities of many other nations are increasing markedly.

- America's K-12 educational system remains *in extremis*, especially in the areas of science and technology—disciplines where space activity seems to be one of the few pursuits that truly inspires many of our young people.
- There remains continuing concern over the apparent loss of some of NASA's innovativeness, management acumen and systems engineering skill. At the same time, NASA, without question, remains the finest space organization in the world, producing remarkable accomplishments on a continuing basis and doing so openly and publicly for all to observe . . . for better or for worse. Nonetheless, few would confuse the NASA of today with the NASA of the Apollo era.

Unfortunately, much of the public, and, of even greater concern, some at NASA, seem to take for granted these incredible achievements. Dan Goldin, when he was serving as Administrator of NASA, shared with me an incident

concerning a citizen who had complained to him about NASA spending substantial sums of money on meteorological satellites, asking, “Why do we need meteorological satellites? We have the weather channel”.

I would like now to turn to some of our commission’s findings and recommendations. They are, I believe, surprisingly relevant today, even though well over a decade has passed since they were first stated. I will cite thirteen of the more significant of these findings and will address each only very briefly in deference to the time available.

- First, we found a NASA which was badly overcommitted in terms of the funding demands of the programs it was undertaking as compared with the funding which was available. The Space Shuttle and the Space Station were major consumers of that budget, leaving little room for other initiatives while making smaller projects highly vulnerable to

the consequences of cost-growth in these two major programs. A primary concern was the lack of adequate reserves in terms of time, schedule and technological approaches—a condition which exacerbated the potential impact of risks already inherent in NASA’s challenging endeavors.

- Second, in the post-Apollo period there seemed to be a lack of a broadly embraced national goal for our space program . . . some would even say that America was lost in space. At the same time, our commission believed that it was inappropriate to set a firm date to achieve a specific major space goal given the then-prevailing budgetary circumstances. Rather, we felt it was important to invest first in building a solid technological foundation for whatever was to be America’s long-term program and thereafter to conduct that program on what we called a “go-as-you-pay” basis . . . an approach that was recognized as differing markedly from

the highly successful strategy adopted by President Kennedy for the Apollo program. Our recommendation was merely a reflection of the fact that times had changed and that large sums of additional near-term money to underpin a major space venture, such as a human Mars program, were unlikely to be forthcoming.

- Third, we concluded that America's space program should be a *balanced* program, involving both humans in space and the use of robotic spacecraft. Although there were those who exclusively advocated robotic systems, it was our belief that public support for the overall space program would diminish rapidly were the nation to adopt a purely unmanned approach to space exploration. As we pointed out in our report, the difference between Hillary reaching the summit of Mt. Everest and simply lobbing a rocket carrying an electronic package to the mountain's crest is immense in terms of the inspiration humankind derives from the feat.

- Fourth, we concluded that science should be the first priority of our space program . . . since science is the basis of new knowledge and thereby forms the underpinning of technological progress.
- Fifth, there should be a mission to the planet earth as well as a mission from the planet earth, the former focusing on the earth's biosphere and the need to protect our planet from harmful activities which take place here on earth.
- Sixth, space transportation was, and I might note is, the primary impediment to a continuing healthy space program. It was concluded that we should not use humans in space merely as "truck drivers" . . . rather, we should limit their role to instances where humans *insitu* can in fact make a difference. In short, we urgently needed to mitigate our dependence on the Space Shuttle for logistical missions.

- Seventh, very high priority was placed on developing a new unmanned (but potentially man-ratable) launch vehicle with a relatively heavy lift capability. In this regard, we recommended, as an economic move, that no additional Shuttles be built.
- Eighth, the operation of the Space Shuttle should not be viewed, as had increasingly been the case in the late 1980s, as being somewhat analogous to running an airline. The Shuttle was, and is, best characterized as an advanced development program operating in a very unforgiving environment.
- Ninth, we noted quite explicitly that it was not a matter of *if* we would lose another Space Shuttle but only a matter of *when*. This unfortunate conclusion was based on our belief that the reliability estimates which were then being attributed

to the Shuttle were grossly optimistic. In fact, we predicted that such a loss would probably occur “in the next several years” and we went on to note that if America does not have the will to endure occasional losses—having taken all reasonable steps to try to avoid them—we should then reconsider whether our nation belongs in space at all. Space is inherently a dangerous and risky place . . . one which is altogether unforgiving of human failings. No one realizes this more than the astronauts who fly our machines into space.

- Tenth, the Space Station program needed to be restructured to place it on a more conservative schedule and more realistic financial basis, importantly including the provision of adequate reserves.
- Eleventh, there was a need to proceed with dispatch in the development of some form of a space rescue vehicle . . . a

vehicle which could perhaps perform other important missions as well.

- Twelfth, we concluded that a human trip to Mars is the correct long-term goal for America's space program, using the moon as a stepping-stone along the way. Other possible missions were considered, including establishing a permanent station at the neutral gravity point in the earth-moon system. This would in fact produce a useful way-station for exploration of deeper space, however it provides an altogether uninteresting locale for most other forms of scientific enterprise. Alternatively, one could increase the effort focused on earth-orbiting spacecraft, however, the Space Station seemed to be handling that goal very adequately and was itself likely to suffer from the law of diminishing returns in the longer-term. Missions to Phobos and Deimos appeared exciting, but could be accomplished as a part of a Mars project. Missions to other space objects

would seem to be candidates for the more distant future.

Thus, a return to the moon followed by a Mars mission seemed to us to be the correct long-term goal for America's space program.

- Thirteenth, and lastly, NASA's management structure, engineering approach and overhead costs needed to be streamlined. As with many mature organizations, the drive toward self-perpetuation seemed to be overtaking enthusiasm for innovation. The various Centers were often engaged in non-constructive competition with one another, seemingly united only in their not-infrequent skirmishes with NASA headquarters.

That, then, summarizes the principal findings of our commission of fourteen years ago. As I have noted, most of these observations seem quite relevant even today.

Now, with your permission, I would like to conclude my remarks with four very brief observations not on behalf of our commission but on my own stead.

First, if America is to have a robust space program it is critical that we build a national consensus as to what that program should comprise. If, for example, we are to pursue an objective that requires twenty years to achieve, that then implies we must have the sustained support of five consecutive presidential administrations, ten consecutive Congresses and twenty consecutive federal budgets—a feat the difficulty of which seems to eclipse any technological challenge space exploration may engender. This consideration argues for a major space undertaking that could be accomplished in step-wise milestones, each contributing to a uniting long-term goal. Such an approach has the added advantage that it reduces the risk associated with individual steps. It is this consideration which justifies a mission to Mars

with an initial step to the moon—as philosophically opposed to a return to the moon with a potential visit to Mars.

Second, I believe that the exploration of space with humans offers many scientific, technological and economic benefits. But these tangible benefits are, in my opinion, not sufficient *in themselves* to justify the cost of the undertaking. To do the latter one must assign value to *intangibles*, intangibles such as the excitement of exploring the unknown; of creating new knowledge; of stimulating science and engineering education; of undertaking challenging and inspiring goals; and of demonstrating to the world what America can do when it puts its mind to a task. Critics will of course suggest that we cannot afford such “luxuries” in a time of great and legitimate demands to address compelling earthly problems—but if they are correct, one must also ask whether we can then afford football stadiums, Hollywood entertainment, golf courses and a thousand other well accepted pursuits.

Third, and this is extremely important, it would be a grave mistake to try to pursue a space program “on the cheap”. To do so is in my opinion an invitation to disaster. There is a tendency in any “can-do” organization to believe that it can operate with almost any budget that is made available. The fact is that trying to do so is a mistake—particularly when safety is a major consideration. I am not arguing for profligacy; rather, I am simply pointing out that space activity is expensive and that it is difficult. One might even say that it is rocket science!

Significant funding will still be required for many years to support the operation of the Space Station and Space Shuttle. The NASA infrastructure itself absorbs substantial funds, as does the very important NASA research program. And there is always the problem that technology advances so rapidly that any project proceeding at too leisurely a pace will find itself constantly undertaking redesigns due to the obsolescence of the components it incorporates . . . sort of a never-ending “do-loop”.

And finally, as a general observation, I would like to strongly affiliate myself with the President's recently announced plan to send humans to Mars and to do so via a lunar way-station. One-day humans *will* stand on Mars. The only question is *when* . . . and *who*. The first Martian may well be in the fourth grade right now. Hopefully, somewhere in the United States.

Thank you.

NORMAN R. AUGUSTINE was raised in Colorado and attended Princeton University where he graduated with a BSE in Aeronautical Engineering, magna cum laude, an MSE and was elected to Phi Beta Kappa, Tau Beta Pi and Sigma Xi.

In 1958 he joined the Douglas Aircraft Company in California where he held titles of Program Manager and Chief Engineer. Beginning in 1965, he served in the Pentagon in the Office of the Secretary of Defense as an Assistant Director of Defense Research and Engineering. Joining the LTV Missiles and Space Company in 1970, he served as Vice President, Advanced Programs and Marketing. In 1973 he returned to government as Assistant Secretary of the Army and in 1975 as Under Secretary of the Army and later as Acting Secretary of the Army. Joining Martin Marietta Corporation in 1977, he served as Chairman and CEO from 1988 and 1987, respectively, until 1995, having previously been President and Chief Operating Officer. He served as President of Lockheed Martin Corporation upon the formation of that company in 1995, and became its Chief Executive Officer on January 1, 1996, and later Chairman. Retiring as an employee of Lockheed Martin in August, 1997, he joined the faculty of the Princeton University School of Engineering and Applied Science where he served as Lecturer with the Rank of Professor until July, 1999.

Mr. Augustine served as Chairman and Principal Officer of the American Red Cross for nine years and as Chairman of the National Academy of Engineering, the Association of the United States Army, the Aerospace Industry Association, and the Defense Science Board. He is a former President of the American Institute of Aeronautics and Astronautics and the Boy Scouts of America. He is currently a member of the Board of Directors of ConocoPhillips, Black & Decker, Procter & Gamble and Lockheed Martin and was founding chairman of In-Q-Tel. He is a member of the Board of Trustees of Colonial Williamsburg and Johns Hopkins and a former member of the Board of Trustees of Princeton and MIT. He is a member of the President's Council of Advisors on Science and Technology and the Department of Homeland Security Advisory Board and was a member of the Hart/Rudman Commission on National Security.

Mr. Augustine has been presented the National Medal of Technology by the President of the United States and has five times been awarded the Department of Defense's highest civilian decoration, the Distinguished Service Medal. He is co-author of *The Defense Revolution* and *Shakespeare In Charge* and author of *Augustine's Laws* and *Augustine's Travels*. He holds eighteen honorary degrees and was selected by Who's Who in America and the Library of Congress as one of the Fifty Great Americans on the occasion of Who's Who's fiftieth anniversary. He has traveled in nearly 100 countries and stood on both the North and South Poles.