Testimony of

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at a Hearing on

Decisions on the Future Direction and Funding for NASA: What Will They Mean for the U.S. Aerospace Workforce and Industrial Base?

Committee on Science and Technology
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Chairman Gordon, Ranking Member Hall, and distinguished members of the Committee:

I want to thank you for the opportunity to address a subject of great importance to the aerospace sector and to the nation as a whole. At a time when our country is intensely focused on economic recovery and employment growth, it is especially relevant to underscore that aerospace engineering and manufacturing enterprises in America directly employed about 650,000 people in 2008 and generated total industry sales of $240 billion, or almost 2% of our GDP last year. Aerospace jobs are relatively high paying, with average manufacturing wages in the sector being some 50 percent higher than in the average industry. In addition, the sector employs nearly 200,000 engineers and scientists, one of the largest concentrations of technical brainpower on Earth. Moreover, the aerospace sector produces state-of-the-art products that are in high demand around the world, generating a record trade surplus of approximately $60

billion on total exports of almost $100 billion last year. This placed the sector at the top of all U.S. export industries, including agriculture. Altogether, factoring in its ancillary industries and multiplier effects, our domestic aerospace sector today supports approximately five million American jobs.

Behind all of these numbers, of course, are the actual men and women who work in the aerospace sector and whose creativity, expertise, and dedication propel it forward. As President of the American Institute of Aeronautics and Astronautics for the 2009–2010 year, I am proud to represent a constituency of more than 36,000 aerospace professionals and students who work in all 50 U.S. states. Indeed, for nearly 80 years, AIAA has been the principal professional society for aerospace engineers and scientists in America and around the world.

In the short videos that accompanied my oral testimony, we heard professionals discuss what inspired and motivated them to join the aerospace workforce in the first place. Now I would like to explore in a more systematic fashion the factors that attract and retain members of the nation's aerospace workforce, while highlighting the critical importance of a credible, long-term U.S. government commitment to human space flight that ensures that our country continues to benefit from a vibrant aerospace sector. I will address in order the three questions that the Committee has posed to me on today's hearing topic.

1. ***As the leader of a major aerospace professional society, what do you view as the most significant concerns and trends regarding the U.S. aerospace workforce – government and contractor – and industrial base?***

The aerospace sector is steadily moving towards the edge of a steep demographic cliff. Aerospace workers are the foundation of the industry's current success, yet unique workforce demographics present unprecedented challenges for its future. Up to half of the current aerospace workforce will be eligible for retirement within five years; nearly 15% are eligible to retire immediately. Furthermore, the U.S. aerospace workforce composition does not match national demographic averages. Compared to the total U.S. workforce, America's aerospace industry and related government agencies have a disproportionately large percentage of workers aged 40–55, and a disproportionately small percentage of workers younger than 40. Within the U.S. workforce as a whole, the

number of employees over age 50 amounts to less than 17% of the total; meanwhile, in the aerospace sector, that bracket accounts for 58% of the total. While current economic conditions have temporarily delayed many older aerospace professionals from exiting the workforce, the demographic challenges remain stark. If talented young engineers and scientists are not recruited, retained, and developed to replace the generation that is near retirement, then the U.S. stands to lose the critical economic and national security benefits of the domestic aerospace industry.

Moreover, enrollment rates in our country's college engineering programs have been dropping. The U.S. ranks well behind other countries in the percentage of students earning their first university degree in engineering or science. In many leading European and Asian countries, the percentage of undergraduates receiving their initial degree in engineering or science is between 40 and 50%. In the United States, the corresponding figure is 15%.

At the advanced-degree level, the U.S. also is declining in the number of degrees earned by its citizens. The proportion of Ph.D. degrees earned by U.S. citizens is dropping as well: 34 percent of doctoral degrees in science and 56 percent of doctoral degrees in engineering in the United States are awarded to foreign-born students. To make matters worse, the U.S. ranks behind the European Union and China in Ph.D. degrees awarded in science and engineering. The European Union surpassed the U.S. nearly 20 years ago, and China will likely surpass us in 2010.

In terms of maintaining and strengthening the industrial base, R&D expenditures keep the aerospace sector strong and help maintain U.S. leadership in this area. In the early 1990s, after implementation of the R&D tax credit legislation, private expenditures on R&D rose. Yet even with this incentive, U.S. industry R&D funding is lagging. Perhaps as a result, American companies are lagging in patents. In 2005, only four American companies ranked among the top 10 corporate recipients of patents granted by the United States Patent and Trademark Office. And to further add to this disconcerting

R&D situation, federal research funding is lagging as well. While AIAA enthusiastically applauds the Committee's efforts to fully fund the America COMPETES Act and to increase R&D funding more generally, at least until recently the amount invested

annually by the federal government in research in the physical sciences, mathematics, and engineering combined has continued its long-term decline.

2. ***How important is a commitment to a robust human spaceflight program to the preservation of the workforce, professional skills and capabilities, and the industrial base? If a decision were made to cut back or otherwise change direction in human spaceflight programs, what would be the implications for the workforce and industrial base?***

In terms of preserving and enhancing the specialized workforce that characterizes a vibrant aerospace sector able to contribute to both economic well-being and national security, a credible long-term commitment to human spaceflight on the part of the U.S. government is indispensable. As the Review of U.S. Human Space Flight Plans Committee (better known as the "Augustine Commission") recently noted, "human exploration of space can engage the public in new ways, inspiring the next generation of scientists and engineers, and contributing to the development of the future workforce in science, technology, engineering and mathematics (STEM)." Likewise, the Augustine Commission acknowledged the important role that space flight plays in promoting the nation's commercial interests and sustaining its aerospace industrial base.

When federal commitment to human space programs wavers, the adverse impact on the stock of human capital and related economic output can be highly disruptive. Those thousands of individuals and dozens of communities that experienced the termination of the Apollo program in the early 1970s can attest to this, as well as those who have been or will be adversely affected by the winding down of the Space Shuttle program. One danger in such a context – apart from the impact on individuals – is that the levels of human capital needed to sustain a robust national human space program will drop below critical mass. Another is that young Americans deciding on a career path will eschew space-related fields, as nominally appealing as these might be, due to a justifiably heightened perception of career uncertainty. In that regard, a stable, long-term commitment to human space flight by the U.S. government is necessary to ensure that space technology retains its allure as a career choice for today's students.

The concentration of aging R&D and manufacturing employees was significantly inspired by NASA's early Mercury, Gemini, and Apollo programs, and later was motivated and retained in part by the sustained effort behind the Space Shuttle and International Space Station programs. In other words, to attract individuals into joining and remaining part of the aerospace workforce, we need first to capture their imagination and later provide them with worthwhile, long-term projects to work on.

3. ***What issues regarding the workforce and industrial base do Congress and the White House need to consider as decisions are made on the funding and future direction for NASA, particularly for human spaceflight and exploration?***

Space and missile systems sales accounted for about $47 billion – or around 20% – of the U.S. aerospace industry's $240 billion in total revenues in 2008. Domestic space and missile direct employment generated nearly 80,000 high-technology jobs last year, representing work by hundreds of companies in all 50 states. While human spaceflight programs like the Space Shuttle and International Space Station represented only about 25% of space and missile sales, and a corresponding fraction of direct employment, their influence on the supply of future aerospace professionals is much greater.

By way of concluding my testimony, I commend for your consideration an illuminating result from the Survey of Aerospace Student Attitudes, a 2009 national study – led by Dr. Annalisa Weigel of MIT – of over 600 undergraduates in aerospace engineering departments from 23 schools across the country. Fully 40 percent of current aerospace engineering students cited human spaceflight specifically as the area that first sparked their interest in an aerospace career. This data provides a powerful reason for continuing our nation's human space program and funding it at adequate levels for a sustained period. Clearly, human space flight plays a critical role in ensuring that our country's young people persist in cultivating their STEM-related talents in order to pursue a career option that inspires them. In turn, their dedication and achievements will make our country a stronger, better place in which to live in the 21st century.

Thank you again for the opportunity to address you today.

Mr. David W. Thompson
President

American Institute of Aeronautics and Astronautics

Mr. Thompson currently serves as the President of the American Institute of Aeronautics and Astronautics for the 2009-2010 term. In this role, he leads and represents the interests of more than 36,000 individual members who conceive, design, develop, test, construct and operate air and space vehicles and their associated capabilities, as well as the educators who train these professionals. AIAA is the largest technical society for aerospace professionals worldwide, and is devoted to the progress of science and engineering in both aviation and space.

Mr. Thompson has been Chairman and Chief Executive Officer of Orbital Sciences Corporation since co-founding the company in 1982. Orbital is one of America's leading space-related R&D and manufacturing companies, with 2009 revenues of approximately $1.2 billion and a workforce of 3,600 people. The company is the industry leader in providing smaller, more affordable space systems to commercial and government customers around the globe. Since the early 1980's, Orbital has built and delivered more than 700 rockets, satellites and other space systems, in support of commercial communications, Earth and space science, and national defense applications.

Before co-founding Orbital, Mr. Thompson was special assistant to the president of Hughes Aircraft Company's Missile Systems Group and was a project manager and engineer on advanced rocket engines at NASA's Marshall Space Flight Center. As a college student, he worked on the first Mars landing missions at Caltech's Jet Propulsion Laboratory and on Space Shuttle projects at NASA's Langley Research Center and Johnson Space Center.

As a result of his work at Orbital, Mr. Thompson was awarded the National Medal of Technology, was honored as Virginia's Industrialist of the Year, and was named High-Technology Entrepreneur of the Year. In addition, he received the National Air and Space Museum Trophy from the Smithsonian Institution, was selected as Satellite Executive of the Year by Via Satellite Magazine, was recognized with the Arthur C. Clarke Lifetime Achievement Award, and was presented with the World Technology Award for Space by The Economist Magazine.

Mr. Thompson is a Fellow of the American Institute of Aeronautics and Astronautics (AIAA), the American Astronautical Society, and the Royal Aeronautical Society, and is a member of the U.S. National Academy of Engineering and the International Academy of Astronautics. He received a B.S. in Aeronautics and Astronautics from Massachusetts Institute of Technology, a M.S. in Aeronautics from California Institute of Technology, and an M.B.A. from Harvard Business School.

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