

UNITED STATES SENATE
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

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Testimony to the US Senate Committee on Commerce, Science, and Transportation
The Museum of Flight, Seattle, Washington

October 24, 2011

The US competitiveness in Aerospace can no longer be taken for granted in the international aerospace market. There was a time, up to the early 1980's, when Boeing was widely recognized to be the world leader in commercial aviation, playing a dominant role in the aviation marketplace. By the 1990's it was clear that that picture had changed. Airbus was demonstrating that it could produce commercial airplanes which were extremely competitive in performance, quality, and cost-effectiveness. Although the American aerospace industry understands that, I am not so certain that American society as a whole appreciates the full scope of the highly technical challenges we face as a nation. This Committee clearly does, and I am very happy to be here to share my perspectives on one key aspect of meeting these challenges: our engineering workforce, in particular, how we might work together to better meet the workforce needs of the aerospace industry in the United States.

I would say that the issue of guaranteeing a strong force of skilled workers to fill the aerospace jobs of the future has at least two key aspects: quantity and quality. Let me address the issue of quantity first.

Speaking from the standpoint of the Department of Aeronautics and Astronautics at the University of Washington, we are facing substantial challenges on the issue of expanding the size of our programs to meet the increasing demand for graduates trained in aerospace engineering. To an extent, this is an issue of the infrastructure and facilities needed to accommodate the number of students. Many good students are being turned away from our program due to class size limits which arise for these reasons. Perhaps more critically, there is a need for more university personnel if programs are to grow to meet the increasing demand for engineering graduates, thus more professors, instructors, and more support staff are required. The University is being severely strained by the economic downturn and the budget austerity that it is forcing on the government of the State of Washington. Budget cutbacks have forced, for example, significant staff layoffs, the cancellation of laboratory and other courses, and have severely restricted our ability to hire new faculty.

These staffing challenges tie directly into the issue of program quality, which in turn directly impacts the quality of our graduates. The UW needs to be able to hire and retain top-quality faculty and support staff, given that the UW is a world-class, major research university. Our graduate programs, which produce master's and doctoral degrees in aerospace engineering, depend directly on the expertise and research opportunities afforded by working with top-caliber

aerospace experts on cutting-edge aerospace research projects. Our undergraduate program in aeronautics and astronautics also benefits from the teaching provided by world-class faculty experts in aerospace. To attract, and retain, these experts we need an environment that provides a solid research and educational infrastructure, as well as funding possibilities that allow the faculty to successfully conduct their research and educational activities. The federal government has a clear, ongoing role to play here, through the funding of research. Ensuring robust federal funding of research in engineering and science is key to sustaining major universities such as the UW. The success of universities is, in turn, essential for graduating the necessary new aerospace engineers.

Regarding support for research in aerospace, I have sometimes heard, with dismay, a comment to the effect that aerospace is a “mature” technology, and not in any great need of new research. I would like to emphatically state that this is not true. While it is true that we can routinely and safely cross continents and oceans in high-capacity jetliners, carry out amazing and effective aviation military missions, and successfully launch spacecraft into earth orbit and beyond, there are serious challenges ahead for aerospace in the coming decades. These include meeting increasingly stringent requirements for low noise and exhaust emissions, the extensive use of composites and other advanced materials, new strategies for aircraft controls to reduce critical airspace crowding and further increase fuel efficiency, and more. That aviation will remain a critical technology for both the American economy as well as its military is without question. In any case, the future of aviation, and of the institutions of higher education which are the source of new engineers for the aerospace workforce, depends on a strong level of federal support. Furthermore, direct federal support for students, whether it is in the form of student grants, fellowships, or loans, is also vitally important to this mission and must be continued, and strengthened.

Increasing the quality of our aerospace graduates and their effectiveness in the workforce is not, however, simply an issue of state and federal funding. To truly increase the effectiveness of new graduates entering the engineering workforce, in my opinion, calls for increasing collaboration between university and industry in the areas of education and research. There is already a significant degree of connection between the two entities. For example, many of our students undertake co-ops and internships in industry, a clearly beneficial experience for the students and the host company alike. From the university side, I think we need to increase the amount of business-related training we offer to students to increase their effectiveness as they begin their careers in industry.

I believe government can play a vital role in further increasing and strengthening the connections between university and industry. As one example, some years ago the National Science Foundation introduced a concept of “broader impact” into its engineering research proposal requirements. The expectation is that the funded projects result not only in excellent science, but contribute meaningfully to other aspects of intellectual activity, such as innovations in education, K-12 outreach, and encouraging under-represented minorities (a major source of new talent for science and engineering) – all important and positive activities in aerospace engineering education. In the same spirit perhaps similar expectations for significant industry involvement could be implemented, where appropriate, as part of federally-sponsored research programs in science and engineering. One example of such a program is the NSF GOALI program, which

directly promotes university-industry partnerships. This kind of program should be strengthened and expanded.

One challenge is that though a clear commitment to excellence in aerospace is common to both academia and industry, their missions are different. Fundamentally, the focus of an academic unit is on education, research, and training; that of industry, on development, commercialization, and production. Forming effective partnerships requires leadership and commitment from both industry and academia to work jointly to strengthen the education of our new aerospace professionals.

To briefly summarize, I would say that what is needed to strengthen the quantity and quality of new engineers entering the aerospace workforce is not merely to increase state and federal funding of universities, though that is clearly important, but to develop and implement mechanisms for greatly increasing the degree of academic-industry partnering in the US.

Thank you very much for giving me the opportunity to share my thoughts with you today.