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August 1, 2012

House Subcommittee on Research and Science Education

*"The Relationship Between Business and Research Universities; Collaborations Fueling American Innovation and Job Creation"*

2318 Rayburn House Office Building

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Chairman Brooks, Ranking Member Lipinski, and Members of this Subcommittee:

Thank you for the opportunity to participate in today's hearing. On behalf of the 62,000 engineers, scientists, and IT professionals at Lockheed Martin principally engaged in the research, design, development, manufacture, integration, and sustainment of advanced technology systems, products and services, and the greater population of 120,000 employees, we appreciate this opportunity to discuss the relationship between business and academia.

My name is Dr. Ray O. Johnson, and I am the Senior Vice President and Chief Technology Officer at Lockheed Martin. As an Officer of the Corporation and a member of the executive leadership team, I guide the Corporation's technology vision and provide corporate leadership in the strategic areas of technology and engineering across a portfolio of more than 4,000 programs.

This year, Lockheed Martin celebrates its Centennial anniversary – a one-hundred year legacy of discovery, invention, and innovation that have had a lasting impact on our society…from man's first attempts at flight…to systems for controlling the world's air traffic…to our earliest exploration of space.

Against that backdrop, it is fitting to discuss the tremendous value of the collaboration between business and universities. These relationships lead to the development of new innovations that have a profound impact on our lives and create jobs in this country.

To begin, I would like to share how Lockheed Martin approaches our relationships with universities.

We proactively develop and maintain relationships with universities and academic institutions globally to facilitate, encourage, and enable utilization of university research and the resultant insertion of university technology in Lockheed Martin programs and products. For 2012, we plan to make research and development contributions to universities of approximately $20 million.

While we invest in a wide variety of technical domains, we are increasingly concentrating our efforts in fewer, larger partnerships with universities focusing on the strategic areas of Energy, Nanotechnology and Advanced Materials, Logistics and Sustainment, Cyber Security, and Healthcare.

University collaboration is an inherent part of our Company's innovative culture. Some of our relationships literally span decades, as is the case of the University of Maryland. In 1944, one of our Company's founders, Glenn L. Martin made a gift of $1.7 million to the University with the funds targeted for aeronautical sciences. A second gift, totaling $800,000, followed the next year. These gifts helped the University construct engineering facilities and provide full-time instruction in aeronautical sciences. In fact, one of our heritage companies, the Glenn L. Martin Company, hired the University's first master's level graduate in aeronautical sciences, Mr. Dale Scott.

Over the years, the relationship with the University of Maryland has only intensified. We have hired thousands of Maryland graduates, and many Lockheed Martin executives have served on the school's Boards, including our former, current, and incoming chief executive officers. I currently serve on the Board of Visitors for the Clark School of Engineering. Our investments have helped the school expand its resources; as you walk around the campus, you will see the Lockheed Martin name on several buildings, labs, and rooms.

We entered into a new chapter of our relationship in 2010 with the signing of a strategic agreement that provides the framework for current and future cooperation. The agreement has three target areas. They are the establishment of Centers of Collaboration, the joint pursuit of business opportunities, and enhanced research and development. Our initial commitment is $1 million per year for three years. The focus for much of our work is on cyber security, logistics and sustainment, and energy.

In addition, we are working with nearly two-dozen other U.S. institutions on a number of initiatives, ranging from complex systems and software to energy and sustainability.

One of the areas of greatest university investment for Lockheed Martin is nanotechnology. Since 2007, we have strategically invested in the research, development, and manufacturing of next generation advanced materials and nanotechnology solutions. Through these initiatives, we are advancing the 21st century materials revolution.

As part of these efforts, we entered into a multi-year, multi-million dollar partnership with Rice University in 2008, focused on nanotechnology research. Through this partnership, we created the *Lockheed Martin Advanced Nanotechnology Center of Excellence at Rice University*, otherwise known as LANCER. We are working together today to leverage the science behind nanotechnology in order to produce materials that are more capable, more affordable, and easier to manufacture than ever before.

Our efforts through LANCER are concentrated on materials and composites that can have significant benefits for people, systems, vehicles, and aerospace platforms. Based on the success of this work over the past five years, we are currently in the process of expanding LANCER to a consortium with other institutions to facilitate regional economic development from a broader base of both public and private cooperative investments.

This work is part of a much larger set of Lockheed Martin-led nanotechnology initiatives that have enabled us to develop carbon nano-reinforced polymer materials that are being applied, for example, on the Juno spacecraft. In addition, we are in the beginning stages of establishing an industry-led, multi-sector Carbon Nanostructures Consortium. This Consortium is part of a broader effort, the Materials Genome Initiative, announced by the White House as an ambitious challenge to double the speed and cut the cost of discovering and deploying new advanced materials in the U.S. to revive and revolutionize American manufacturing.

With an investment of $5 million over five years, in 2009, Lockheed Martin became a Sustaining Member of the MIT Energy Initiative, which has an ambitious goal of transforming how the nation produces and consumes energy. The Initiative supports a portfolio of diverse, high-impact energy research projects. We direct a majority of the investment to targeted research in the areas of alternative energy, energy storage and distribution, as well as energy efficiency and management.

I would also like to discuss Orion – a program that this Subcommittee knows well. Lockheed Martin is proud to be a partner with NASA. The Orion program has a planned goal of committing $18 million for historically African American colleges or universities and minority institutions, depending on program budget allocations. Lockheed Martin is also partnered with the University of Texas-El Paso, the nation's largest Hispanic serving university. Students there have performed design and analysis of some crew module structures and mechanisms, and they have also designed and manufactured test fixtures.

This work is exciting for Lockheed Martin and for the students. It inspires these students to consider science and engineering careers. It is interesting to note that in the first week following the Orion award in August 2006, Lockheed Martin and our major teammates opened 1,300 job requisitions for related positions. We received 33,000 responses from qualified individuals, a large percentage of them new college graduates.

The aforementioned are just a few examples of our work with universities; you will see a consistent theme throughout. We are looking for game-changing inventions, not evolutionary improvements, which we can develop into revolutionary innovation. We work with universities because their inventions become the basis for our innovations; they help us reach critical milestones in the delivery of affordable solutions to our customers.

By working with universities, we increase our ability to be innovative by partnering with some of the nation's most renowned thinkers; many with perspectives that are different than our own. Diversity is crucial to innovation, a diverse working group breeds diverse thinking, which is a critical component of invention and innovation.

To begin the research selection process, we share our corporate strategic technology interests with the universities. Based on these strategic interests, the universities bring their research ideas forward. Then Lockheed Martin technical teams meet with the university researchers to select the most promising proposals for funding. This expert-to-expert collaboration leads to research partnerships, which are the most effective way of turning inventions into innovations.

Our collaboration with universities extends beyond research and development to talent acquisition and workforce development.

Lockheed Martin is a large employer of entry-level talent, recruiting close to 1,800 full-time, intern, and co-op students annually. Over 75% of our skill needs are for technical talent. The skills most in demand are computer science, systems engineering, and electrical, computer, mechanical, and aerospace engineering.

To meet those needs, we develop relationships with faculty, staff, and student organizations through activities such as curriculum development, classroom presentations, advisory board participation, sponsorship of senior design competitions, support of student projects and activities, scholarships, and financial support. Through these activities, we have established relationships of mutual benefit with over 100 U.S. colleges and universities. We seek partnerships with institutions known for academic excellence, diversity, and research expertise. Additionally, these schools are often the top universities where we sponsor research.

In terms of curriculum tailoring, we support over 100 advisory boards at universities nationwide. Some examples include our work at UCLA on mechanical and aerospace engineering, at Purdue University on cyber security, and at Texas A&M University on electrical engineering.

In addition, we have supported academic sabbaticals and teaching partnerships with several universities, such as the University of Colorado, Drexel University, and Villanova University.

We also maintain a volunteer staff of technical university liaisons. These senior Lockheed Martin technical experts tend to be university alumni that have a passion for maintaining strong ties between Lockheed Martin and their alma mater.

For all of the benefits that university collaboration provides in terms of research and talent, Lockheed Martin, like many companies in the present economic reality, is aggressively reducing costs. This reality is putting increased pressure on research funding.

Sponsored research generally advances knowledge within a domain in the form of research results, papers, and presentations. The positive financial implications of this work often occur over time horizons that stretch far beyond immediate sales forecasts. Sometimes, university research is necessarily reduced when weighed against more critical expenses that have more near-term impact.

There is also a perception that University Research Agreements are exceptionally difficult to negotiate, specifically with regard to Intellectual Property, or IP, rights. Generally, we are able to negotiate the rights we need while still allowing each university the freedom to pursue its activities. However, we have noticed an increasing reluctance from universities to grant IP rights to research sponsors. As companies across the United States reduce their research investments, universities are seeking other sources of income to compensate, and some universities appear to regard IP as a source of future licensing revenue or the foundation for spinning off potential start-up companies. Consequently, in rare occasions, we are not able to come to agreement over the rights that we need to make the financial investment in a given area of research. For some companies, though, this growing IP struggle may have the unintended consequence of reducing corporate appetites for collaborative research, thus stranding high-potential ideas.

Despite the aforementioned challenges, industry has and will continue to play an important role in the future of university research. Businesses will continue to make investments as they look to diversify into new markets and domains. University research provides fundamental scientific and technological knowledge that underlie breakthroughs – the inventions. Businesses will likely continue to grow both their talent pools through targeted talent acquisition and their knowledge and capabilities through strategic, sponsored research. Research is fundamental to innovation, economic development, and maintaining national security.

The National Academies report titled "*Research Universities and the Future of America"* offers several important recommendations to help overcome the existing challenges and enable even greater collaboration among business and universities. We would like to address the three recommendations that we consider among the top priorities.

Recommendation #1. We strongly endorse the adoption by the federal government of stable and effective policies, practices, and funding for university-performed R&D and graduate education. Innovation can be a fragile process, and budget constraints and uncertainties can cause significant delays, sometimes derailments, and the loss of technical talent. By having a secure financial backdrop, researchers can focus on their research, and we continue to produce the science, technology, engineering, and math, or STEM, graduates that are vital to our economic security.

Recommendation #3. We strongly endorse the need to strengthen the business role in the research partnership, facilitating the transfer of knowledge, ideas, and technology to society and accelerating the "time-to-innovation" in order to achieve our national goals.

Especially important is the federal re-establishment of the research and development tax credit, preferably a permanent and enhanced R&D Credit. The United States has long led the world in science and technology by nearly any measure, from the disproportionate number of Nobel Prizes awarded to scientists working domestically to the preeminence of American military hardware. This leadership generates high-skill, high-wage jobs, both for those who perform the research and those who manufacture the products derived from the research and development. When R&D is performed in the U.S., the highly skilled scientists and engineers along with the institutions, including universities that train and develop this workforce, are maintained and strengthened. However, other countries have introduced even stronger incentives or outright subsidies specifically directed toward R&D activity within their borders.

As the Committee is aware, the current credit expired, along with other business tax extenders, at the end of 2011. The uncertainty and unpredictability that result from the temporary status of the R&D Credit in the United States further dampens its effectiveness as an inducement to engage in long-term R&D projects. The lapse or extinguishment of this tax credit could have a chilling impact on research investments at the university level.

Recommendation #9. We strongly support securing for the United States the full benefits of education of all Americans, including women and underrepresented minorities, in science, technology, engineering, and math. My own childhood experiences emphasize for me the importance of this recommendation.

For example, as a teenager, I enjoyed putting together kits that contained all of the components for a piece of electronics. The projects were very satisfying to me, because I was able to build my own clock or television.

Those projects increased my love of science and mathematics – so much so that I went on to earn a Ph.D. in electrical engineering. As with students today, these hands-on activities helped me move from the theoretical side of technology, taught in the classroom, to the practical side, learned by doing.

On a personal level, my hope is that children across the country – especially those from underrepresented groups – are exposed to science, technology, engineering, and math, and that they are excited by what they can achieve with a STEM education.

On a professional level, there is generally an increasing competition among employers for skilled technical U.S. talent. As I mentioned earlier, Lockheed Martin is one of the largest employers of entry-level technical talent in the U.S. We need to ensure the development of the next generation of engineers, computer scientists, researchers, and technologists. However, demand for this expertise exceeds the supply by 2.5 to 1. I have a growing concern that countries that produce a greater number of STEM graduates will challenge the United States' competitiveness. Part of how you address concerns about competitiveness is to make sure we are developing a workforce that is simply the best.

As I indicated earlier, the report has many important recommendations. In our opinion, the three that I discussed would provide some of the most significant impacts and they are attainable. Having consistent policies would provide a stable backdrop for research. Providing for a permanent R&D tax credit would enable companies to make investments in U.S. universities, driving wealth and job creation through innovation. Helping students realize their potential through science, technology, engineering, and math education would guarantee our nation the next generation of researchers that we so desperately need.

In closing, I want to reiterate my appreciation for the opportunity to join you today. The Committee is addressing extremely important issues that not only impact American business, but they also have the potential to benefit every person in our country, as innovation benefits us all.