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Thank you, Mr. Chairman, Ranking Member McKeon, members of the committee. I am honored, and Raytheon is honored, to be here today to speak about a subject that is so important to the future of our country: improving our educational system. We thank you for the opportunity to share with you how Raytheon is trying to help.

Raytheon has a stake in this discussion because we are a technology company that depends on the expertise of our people to provide innovative solutions to meet our customers' important needs.

Specifically, Raytheon specializes in defense, homeland security, and other government needs throughout the world. We provide state-of-the-art electronics, mission systems integration and other capabilities in the areas of sensing; effects; and command, control, communications and intelligence, as well as a broad range of mission support services.

Our company employs 72,000 people worldwide, in over 40 states and the District of Columbia, with over 12 thousand people in the state of California alone. About half of our employees are engineers, mathematicians, scientists and technicians.

We believe it essential to secure the technical talent pipeline for the future. With a great generational transition on the horizon -- as "baby boomers" grow nearer to retirement -- we believe it is imperative to help our students prepare now for the skills they will need later to enter careers in Science, Technology, Engineering and Mathematics (STEM).

Raytheon has a multi-pronged approach to education, both internal and external.

Like many employers, we provide educational assistance to our employees through tuition reimbursement. In 2007, we provided more than $14 million in assistance to about 3,800 employees attending college. In addition, we expect to provide our employees with about 1.8 million hours of in-house training in 2008 to improve their skills and capabilities.

Externally, our most visible activity is our MathMovesU® program. MathMovesU is designed to engage middle school students on their own terms and make the connection between math, their interests, and "cool" careers. The program's cornerstone uses their favorite medium – an interactive web experience.

The website is "immersive," designed to create "aha" moments by presenting math in its relation to some of the topics middle school students care most about -- music, sports and fashion. It uses a variety of puzzles and games to encourage the development of math skill in fun and creative ways. If someone in your family is in the target age group, you may want to encourage them to check out MathMovesU.com and pick an "avatar." If you're not sure what an avatar is, believe me, they'll know!

The goals of MathMovesU are to:

- Transform math's image among middle school students.
- Motivate American students to meet their potential in math and science education.
- And to help create and sustain a strong, talented and diverse workforce by supporting math and science education.

Since its inception, the MathMovesU website has attracted over 600,000 visitors from every state and the District of Columbia, and from 107 countries. The program awards more than $1 million annually in scholarships and grants to students, teachers and schools nationwide. This includes 900 MathMovesU scholarships awarded to students along with matching grants awarded to their schools, and 65 "Math Heroes" (teachers and tutors) who each received $2,500 grants.

Over the last two years, Raytheon has invested a total of over $6 million in our children's education, through the MathMovesU program.

In addition to MathMovesU, Raytheon is a national sponsor of MATHCOUNTS®, which is a nonprofit organization that promotes math excellence among U.S. middle school students by providing financial and volunteer resources. Raytheon serves on the board of MATHCOUNTS, supports 6 MATHCOUNTS chapters and 5 state championships, and is the Title Sponsor of the MATHCOUNTS National Competition for 2009-2011.

Raytheon supports as many as 29 FIRST Robotics high school teams across the nation and provides scholarship money to students who have participated in the FIRST Robotics program. FIRST Robotics enables high school students to experience science and engineering through the building of robots and competing against teams from other schools. The excitement at these competitions is intense.

More than 4,000 Raytheon employees volunteer to support math and science education in their communities each year through MathMovesU, MATHCOUNTS, FIRST Robotics and other activities. And we hold more than 100 events annually to engage middle school students in math and science.

In addition to these activities, Raytheon is partnering with the Business-Higher Education Forum to provide corporate leadership to strengthen STEM education and to promote college readiness, access and success for underserved populations, particularly in the STEM disciplines. BHEF is an organization of Fortune 500 CEOs and senior executives, college and university presidents, and foundation leaders working to advance innovative solutions to our nation's education challenges in order to enhance U.S. competitiveness.

Raytheon's Chairman and CEO Bill Swanson has been a member of the Business-Higher Education Forum (BHEF) since January 2004. Mr. Swanson currently is vice chair of the organization, which is chaired by Cornell University President David Skorton.

To remain competitive in the global economy, the American education system must provide an ever expanding and highly talented pool of STEM workers. The downward trend in U.S. science and engineering degree attainment, unless addressed, threatens to significantly affect the size and quality of the workforce available to industry.

In projecting forward from 2002 to 2012, the Bureau of Labor Statistics (BLS) estimates the need for science and technology workers will increase by 26 percent compared to 15 percent for all occupations. They predict the need for computer/mathematical scientists will increase by 39 percent and the need for post-secondary teachers will increase by 37 percent.

Defense contractors in many instances need highly skilled employees who are also U.S. citizens to meet program clearance requirements. So we are acutely aware of the problems that a reduction in the number of highly skilled American STEM workers will create. In addition, the retirement of the baby boom generation will lead to an increase in demand for workers to fill the positions these highly valued employees vacate.

To address this problem, the BHEF launched a multi-year initiative, “Securing America’s Leadership in Science, Technology, Engineering, and Mathematics,” to develop a strategy to double the number of the U.S. STEM college graduates by the year 2015. The initiative is co-chaired by Bill Swanson and Warren Baker, President of California Polytechnic State University in San Luis Obispo.

The BHEF initiative investigates a variety of problems that exist in today’s education system, such as low student participation and declining achievement in STEM subjects relative to other countries, the shortage of qualified STEM teachers, and the lack of participation by women and minorities in many STEM disciplines.

Last year, under the leadership of its STEM working group, BHEF produced a seminal report about how the US could improve the quantity and quality of our nation's math and science teacher workforce. Entitled, "An American Imperative, Transforming the Recruitment, Retention and Renewal of the Nation's Mathematics and Science Teaching Workforce," the report contained over 100 recommendations for state and federal government, K-12 and higher education, and business. A number of recommendations from the report were adopted in the America COMPETES Act.

Raytheon is taking a new approach to examine potential solutions to the challenge of increasing the number of STEM graduates. Our CEO, Bill Swanson, believes that the same systems engineering methods used to create complex aerospace and defense systems for the U.S. government can be applied to the U.S. education system.

As a result, in June 2006, in support of his work as co-chair of the Business-Higher Education Forum's initiative to strengthen STEM education, he initiated an educational systems engineering and modeling project.

After nearly two years of work that included consultations with a number of education experts, we believe that we have demonstrated the utility and potential of educational systems engineering and modeling.

The overarching goals of the modeling activities are to:

- Assist policymakers, educators and researchers in understanding the complex nature of the U.S. education system.
- And to assess potential solutions that will strengthen U.S. STEM capabilities.

Our approach is centered on developing a dynamic systems engineering-based model of the U.S. P-16 STEM education system.

The first project began in September 2006 and was completed in May 2007. Four teams of 5 to 6 experienced systems engineers competed to see which could create the best model of students' progression through the educational system. The model created examines the flow of the students through the education system and calculates how many receive a STEM bachelor's degree.

A second set of projects began in July 2007 and was completed in March 2008. Five teams of 5 to 6 experienced systems engineers worked together to update and improve the initial model. The teams modeled the different outcomes between men and women, and advantaged and disadvantaged students. They improved the higher education aspects of the model and created a California state version of the model. To create the California version we worked with the California Council on Science and Technology (CCST), led by Susan Hackwood and with SRI International.

The total effort expended on the U.S. educational system modeling over the past two years is approximately 12,000 hours by more than 60 experienced engineers. The work we did using systems dynamics techniques has taken the initial steps to help the STEM education effort and has enabled our team to further develop their systems engineering skills.

Of the many proposed improvements to the education system that we examined, we found that some have the potential for providing large gains in the numbers of STEM graduates. Improving the capabilities and experience levels of teachers has a large effect. Improving the networking of college students with others in their field of study through cohort and bridge programs that help them to work together and to share knowledge has a substantial effect. Increasing interest on the part of women and convincing the many capable disadvantaged students that they can and should attend college through mentoring programs can have a large effect.

The modeling effort makes it clear that no single effort will produce a doubling of the college graduates in 10 years. A combination of several coordinated approaches will be required. Systems engineering and system dynamic modeling provide a means of determining what the combination should be and how many resources should be applied to each.

It was also clear from the research we performed that there are many areas where additional research is needed to build data sources and to quantify behavior and, ultimately, to make the model more robust. To accomplish this, a larger integrated community that includes researchers, system modeling experts, policymakers, and practitioners will be required.

For example, we found that additional data is necessary relative to teacher attrition in their first five years. Approximately 50 percent of new teachers quit in the first 5 years. What is not clear from the current data and research is if the most capable are leaving the profession or not. Additional research data in this area will improve the model and allow us to better understand what approach will be most effective at improving student performance.

Our data collection efforts found that there is a great deal of research and analysis on teacher pay and its effects on performance, but very little data on STEM teacher pay. The modeling of proposed changes in STEM teacher pay could not be performed due to lack of data. Also the effects of pay on STEM teacher attrition could not be modeled.

We found that the data sets collected across the 50 states are very different and typically incomplete. We examined California in detail and created specific recommendations for improved data collection.

Better data improves understanding; it enables better modeling and analysis and will allow us to arrive at better conclusions. Improvements in the area of data collection and standardization will provide the information necessary for nationwide comparison and improvement.

As a result of our two years of work on this project, we have concluded that modeling is a viable and promising approach for assessing educational policy changes.

- It helps discover unintended consequences.
- It provides a means of thinking through the problem for a system that is too complex for human understanding.
- Modeling helps to identify data collection requirements and missing parts of the research puzzle.
- And finally, we believe it can provide guidance to policy makers allowing them to compare alternatives and examine combinations of solutions integrated together.

While Raytheon and BHEF have taken the initial steps in the area, there is much more to be done. We are working with the Ohio State University and Kathy Sullivan at the John Glenn School of Public Affairs to form a community of researchers and modelers to expand the effort. It is our belief that supporting this effort can provide great benefit to the U.S education system and we would welcome your support to help us build the community of researchers and modelers who will continue this work.

Thank you.
