

**STEM EDUCATION IN ACTION:
LOCAL SCHOOLS, NONPROFITS, AND
BUSINESSES DOING THEIR PART
TO SECURE AMERICA'S FUTURE**

HEARING
BEFORE THE
SUBCOMMITTEE ON RESEARCH AND SCIENCE
EDUCATION
COMMITTEE ON SCIENCE, SPACE, AND
TECHNOLOGY
HOUSE OF REPRESENTATIVES
ONE HUNDRED TWELFTH CONGRESS

SECOND SESSION

MONDAY, APRIL 30, 2012

Serial No. 112-81

Printed for the use of the Committee on Science, Space, and Technology



Available via the World Wide Web: <http://science.house.gov>

U.S. GOVERNMENT PRINTING OFFICE

78-481PDF

WASHINGTON : 2012

For sale by the Superintendent of Documents, U.S. Government Printing Office
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TO SECURE AMERICA'S FUTURE**

MONDAY, APRIL 30, 2012

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON RESEARCH AND SCIENCE EDUCATION,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, DC.

The Subcommittee met, pursuant to call, at 10:00 a.m., in Bob Jones High School, 650 Hughes Road, Madison, Alabama, Hon. Mo Brooks [chairman of the Subcommittee] presiding.

RALPH M. HALL, TEXAS
CHAIRMAN

EDDIE BERNICE JOHNSON, TEXAS
RANKING MEMBER

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

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Subcommittee on Research & Science Education Hearing

***STEM Education in Action: Local Schools, Non-Profits, and
Businesses Doing Their Part to Secure America's Future***

Monday, April 30, 2012
10:00 a.m. to 12:00 p.m.
Bob Jones High School
Madison, Alabama

Witnesses

- Dr. Camille H. Wright – Director of Secondary Instruction, Madison City Schools
- Dr. Robert A. Altenkirch – President, University of Alabama – Huntsville
- Dr. Marilyn C. Beck – President, Calhoun Community College
- Dr. Neil Lamb – Director of Educational Outreach, HudsonAlpha Institute
- Mr. Andrew Partynski – Chief Technology Officer, Science Applications International Corporation

**U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON RESEARCH AND SCIENCE EDUCATION**

HEARING CHARTER

*STEM Education in Action:
Local Schools, Non-Profits, and Businesses Doing Their Part to Secure America's Future*

**Monday, April 30, 2012
10:00 a.m. – 12:00 p.m.
Bob Jones High School, Madison, Alabama**

1. Purpose

On Monday, April 30, 2012, at 10:00 a.m. at Bob Jones High School, 650 Hughes Road, Madison, Alabama 35758, the Subcommittee on Research and Science Education will hold a hearing entitled *STEM Education in Action: Local Schools, Non-Profits, and Businesses Doing Their Part to Secure America's Future*. The purpose of the hearing is to highlight local science, technology, engineering, and mathematics (STEM) education programs and partnerships and to examine their impact on the next generation of STEM professionals, local jobs, and the U.S. economy.

2. Witnesses

Dr. Camille H. Wright, Director of Secondary Instruction, Madison City Schools

Dr. Robert A. Altenkirch, President, University of Alabama, Huntsville

Dr. Marilyn C. Beck, President, Calhoun Community College

Dr. Neil Lamb, Director of Educational Outreach, HudsonAlpha Institute of Biotechnology

Mr. Andrew Partynski, Chief Technology Officer, Science Applications International Corporation (SAIC)

3. Overview

- An educated and well-trained workforce is essential to the economic prosperity of the United States. In the U.S, student mastery of science, technology, engineering and mathematics (STEM) subjects is essential for 21st century jobs. Today's employers are seeking specific skills and all levels of education to meet their needs. Communities that successfully marry these education needs with community workforce needs help stimulate the local economies.

- As of May 2010, there were over 202,000 occupations in Huntsville, Alabama, and the median annual wage was \$48,000. Eighteen percent (or 35,500) of those occupations were in STEM fields. The median wage for those jobs was \$86,000, nearly twice the average of occupations overall.¹
- Finding ways to improve STEM education activities beyond the scope of the federal government, including using best practices derived from non-federal sources, is key to the future prosperity of the Nation. A growing number of partnerships between industry, foundations, non-profits, and local and state governments recognize the importance of having an educated and skilled STEM workforce and are creatively motivating and inspiring future generations of scientists and engineers with little or no federal funding.
- The Madison City School System is located in Madison, Alabama, and serves the cities of Madison and Triana. The System consists of one high school, two middle schools, and seven elementary schools. The system has a \$60 million operating budget, employs over 600 certified staff members, and serves over 8600 students.
- The University of Alabama, Huntsville is a comprehensive regional university that provides an opportunity to earn a four year, graduate, and/or a doctoral degree.
- Calhoun Community College is a two-year, comprehensive community college that offers educational opportunities in traditional academic studies, occupational/technical programs, and workforce development and community services.
- HudsonAlpha Institute of Biotechnology is a nonprofit organization that develops high-throughput research tools that focus on why disease occurs and applies this knowledge to help patients.
- Science Applications International Corporation (SAIC) is a FORTUNE 500® scientific, engineering, and technology applications company that works to solve problems of vital importance to the nation and the world, in national security, energy and environment, health, and cybersecurity.
- The Administration's Fiscal Year 2013 (FY13) budget request includes nearly \$3 billion in spending for STEM education efforts.

4. Background

STEM Education and Public-Private Partnerships

In the U.S, student mastery of science, technology, engineering, and mathematics (STEM) subjects is essential for 21st century jobs. As other nations continue to gain ground in preparing their students in these critical fields, the U.S. must continue to explore a variety of ways to

¹ *Science and Engineering Indicators 2012 Appendix Tables*. National Science Board. p. 151.

inspire future generations. Finding ways to improve STEM education activities beyond the scope of the federal government, including using best practices derived from non-federal sources, is key to the future prosperity of the Nation.

A growing number of partnerships between industry, foundations, non-profits, and local and regional governments recognize the importance of having an educated and skilled STEM workforce and are creatively motivating and inspiring future generations of scientists and engineers with little or no federal funding. Such partnerships can provide alternative options for education activities outside the scope of public financing and delivery. When designed, implemented and run effectively, a successful partnership can increase efficiency and choice and expand access to educational activities not necessarily found in the classroom. Oftentimes, public-private partnerships allow state and local governments to leverage the specialized skills offered by certain private organizations. Likewise, industry seeks a substantial return on its investment with a highly skilled, highly motivated workforce.

Securing America's Future

Technology and innovation have kept the American economy strong in the face of increasing competition in the global marketplace. There is a significant role for American science and engineering graduates in helping this country's economy keep pace with this rapid change. As industry moves toward producing more high-tech products and employing technology intensive production methods, the need for technologically and scientifically literate individuals at all levels of the workforce will increase. Thus, the need for STEM education and training is now as important for the worker running the production process, as it is for the researcher who created that process.

Many reports find that there are not enough people with the requisite skills to fill the jobs that remain. Encouraging more high school graduates to obtain some form of postsecondary education is critical. Today, some high school graduates are lucky enough to land entry-level jobs in which they can enhance career skills through on-the-job training (for instance, machinists, carpenters, and executive assistants). Expanding opportunities for more high school graduates through vocational schools and community colleges is crucial. According to the *Job Creation and America's Future* report by the McKinsey Global Institute², employers are having trouble filling some positions because they cannot find qualified applicants. Some 40 percent of survey respondents who say that they plan to hire in the next 12 months have had positions open for six months or longer because they could not find the right applicant. More broadly, nearly two-thirds report they routinely have openings that are difficult to fill. Of these, management was the most frequently cited type of position. The most difficult occupational categories to fill were in science and engineering, followed by computer programmers and information technology workers. The growing shortage of workers with sought-after skills is reflected in compensation. Wages for engineers and architects grew by 3.5 percent annually from 2002 to 2010, compared with an average of 2.9 percent for all occupations.

² *Job Creation and America's Future*, McKinsey Global Institute, pg. 48
http://www.commerce.gov/sites/default/files/documents/2011/july/jobs_creation_and_americas_future.pdf

The importance for communities to work together as a whole to overcome this economic hurdle is becoming increasingly evident. Highly involved industry partners are a common theme among the most successful tech-training programs. Representatives from both industry and colleges claim that a willingness to devote time and resources to the partnership is crucial for the program to yield the most qualified graduates.

STEM Education and the Federal Government

Federal STEM Education Funding By Agency
(dollars in millions)

Agency	FY11 Actual	FY12 Estimate	FY13 Request	FY13 Request versus FY12 Estimate	
				\$	%
Department of Agriculture	91	88	91	3	3.5
Department of Commerce	58	55	44	(11)	-20.0
Department of Defense	153	164	153	(11)	-6.7
Department of Homeland Security	2	2	6	4	200.0
Department of Education	561	517	628	111	2.1
Department of Energy	49	48	37	(11)	-22.9
Environmental Protection Agency	20	26	20	(6)	-23.1
Department of Health and Human Services	560	560	554	(6)	-1.1
Department of Interior	1	1	1	-	-
NASA	157	149	117	(32)	-21.5
Nuclear Regulatory Commission	10	16	5	(11)	-68.7
National Science Foundation	1148	1154	1193	39	3.4
Department of Transportation	100	98	101	3	3.1
Totals:	2910	2877	2951	74	2.6

Shading indicates agencies within the Science, Space, and Technology Committee's jurisdiction

A consensus exists that improving STEM education throughout the Nation is a necessary condition for preserving our capacity for innovation and discovery and for ensuring U.S. economic strength and competitiveness in the international marketplace of the 21st century. The National Academies *Rising Above the Gathering Storm* report placed major emphasis on the need to improve STEM education. This recommendation was embraced by the House Science, Space, and Technology Committee following the issuance of the report and was included in the 2007 *America COMPETES Act*. The 2010 *America COMPETES Reauthorization Act* continues this emphasis.

The Fiscal Year 2013 (FY13) budget request proposes \$3 billion across the federal government for STEM education, a 2.6 percent increase over FY12. Administration priorities include \$775 million for NIH awards to prepare individuals for careers in the biomedical, behavioral, and social sciences; \$80 million for training an additional 100,000 effective STEM teachers over the

next 10 years through the Department of Education (ED); and \$176 million for minority programs at ED, the National Science Foundation (NSF), and National Aeronautics and Space Administration (NASA).

As required under the America COMPETES Reauthorization Act of 2010, the Office of Science and Technology Policy's (OSTP) National Science and Technology Council Committee on STEM Education submitted its first annual report, including an inventory of federal STEM education activities, in conjunction with the FY13 budget request. A full 5-year strategic plan is expected Summer 2012.

The annual report identified \$967 million or 28 percent of all federal STEM education funding as being spent on activities that target the specific workforce needs of science mission agencies. The remaining 72 percent of funding is spent on broader STEM education efforts primarily at NSF (47 percent) and ED (40 percent). Of the 252 federally-funded STEM activities identified in the report, none were found to have the same objectives, target audiences, products, or STEM fields of focus. The report acknowledges that "this conclusion should not be interpreted to mean there are no opportunities for improving the alignment, deployment, and efficiency of federal STEM education investments."³

The Government Accounting Office (GAO) has completed a similar report, which identified 209 programs, also totaling over \$3 billion. While this report does not identify specific duplication, it does find overlap with many of these programs.

The Science, Space, and Technology Committee will continue to hold oversight hearings and briefings on STEM education activities and will closely examine the scope and findings of both the OSTP and the GAO federal STEM education inventories, as well the upcoming OSTP strategic plan.

³ *Coordinating Federal Science, Technology, Engineering, and Mathematics (STEM) Education Investments: Progress Report*. Committee on STEM Education, National Science and Technology Council, p. 10.

Chairman BROOKS. The purpose of today's hearing is to highlight local science, technology, engineering and mathematics, or STEM, education programs and partnerships, and to examine the impact on the next generation of science, technology, engineering and mathematics professionals, local jobs, and the United States economy.

In front of you are pamphlets containing the written testimony, biographies, and Truth in Testimony disclosures for today's witnesses.

At this point, the Chair recognizes himself for an opening statement.

I would like to welcome everyone this morning to the Subcommittee on Research and Science Education field hearing, "STEM Education in Action: Local Schools, Non-Profits and Businesses Doing Their Part to Secure America's Future."

It is a privilege to be with you to highlight and discuss local STEM education programs and partnerships and to examine their impact on the next generation of STEM professionals, local jobs, and the United States economy.

It is also my pleasure to welcome my colleague on the Committee on Science, Space, and Technology and Ranking Member of the Subcommittee on Research and Science Education, Democrat Congressman Dan Lipinski, of the great State of Illinois. I have enjoyed working with him the past 15 months and am grateful for his willingness to travel to be here with us today.

I also want to thank Bob Jones High School and the Madison City Schools for hosting us this morning and providing this wonderful facility, as well as each of our witnesses for taking time out of their busy schedules to testify before us on issues of importance to our community and to America.

I remember hearing the loud roar and ground shaking from Saturn V rocket testing on Redstone Arsenal in the 1960s. Many of you have probably attended space camp. These and other science-based events have shaped the fabric of this community and America. I have had the privilege of serving Alabama's Fifth Congressional District for the past 15 months and am proud of the science and technology achievements that Alabama has provided to American exceptionalism.

NASA and the Marshall Space Flight Center have led American exceptionalism in space. We were instrumental in putting Americans into space and onto the moon. We were instrumental in the development of the space shuttle, a three-decade workhorse unmatched by any nation on Earth. Redstone Arsenal's numerous commands have played a key role in developing the gee-whiz-bang weapons that helped make America's warfighters' military successful with minimal loss of American lives.

Tennessee Valley businesses and top-of-the-line schools and research institutions give our citizens high-tech education and employment opportunities as good as any offered in America.

As of May 2010, there were over 202,000 occupations in the metro Huntsville, Alabama, community, and the median annual wage was \$48,000. Eighteen percent, or 35,500 of those occupations, were in STEM fields. The median wage for those jobs was \$86,000, nearly twice the average of occupations overall.

Further by way of background, Federal STEM education funding by the United States is \$2.9 billion. That \$2.9 billion comes from entities such as the Departments of Agriculture, Commerce, Defense, Homeland Security, Education, Energy, Environmental Protection Agency, Health and Human Services, Interior, NASA; in addition, the Nuclear Regulatory Commission, the National Science Foundation, and the Department of Transportation.

Given our background in the STEM fields, North Alabama is an ideal place to promote science, technology, engineering and mathematics education, and it does not hurt that our district can serve as a model for the rest of America in this regard. As you may know, our Subcommittee has jurisdiction of essentially all non-defense and non-medical research and development activities of the Nation. This includes oversight of agencies like NASA; the Department of Energy's Office of Science; the National Oceanic and Atmospheric Administration, which includes the National Weather Service; portions of the Department of Homeland Security; the National Institute of Standards and Technology; and the National Science Foundation, which provides approximately 40 percent of all non-medical basic research at American colleges and universities, including support for STEM education.

The research these agencies spans is important to our Nation's economic success, but at the same time it is also critical to note that America faces unsustainable budget deficits that constitute our greatest economic and national security threat. By way of emphasis, Admiral Mike Mullen, Chairman of the Joint Chiefs of Staff, testified before the House Armed Services Committee last year that our Nation's biggest national security threat is our deficit and accumulated debt.

Mr. Lipinski and I may disagree on certain policy issues, but I am confident that he would agree with me that we must do more to alleviate our deficit and accumulated debt. Likewise, I am sure he would agree with me that an essential element of future United States economic prosperity is a competent, skilled workforce, one that we cannot achieve without strong STEM education efforts, particularly on the local level.

Today we will take a closer look at a few of the STEM education partnerships and initiatives being executed by Tennessee Valley schools, businesses, and non-profit organizations. Also noteworthy are the efforts of other local schools and organizations not testifying before us today.

For example, this Subcommittee had the privilege of hosting Christine Stratton, a teacher at Grissom High School in the District of Columbia, last year to discuss Grissom's robust cybersecurity curriculum. In addition, Aerojet, through the GenCorp Foundation, is strongly committed to STEM education in the Huntsville community, and as most of the Nation knows, the Space and Rocket Center with its space camp has been a sterling example of what museums and other non-profits can do to help the STEM education.

Our commitment to STEM education is exemplified by contributions to STEM programs in the community by the University of Alabama-Huntsville's Propulsion Research Center and related scholarships. I could cite numerous other examples, but it is clear

that STEM education is a top priority for many in our area. I am proud of what this community has been able to accomplish and look forward to learning more about these remarkable initiatives. [The prepared statement of Chairman Brooks follows.]

PREPARED STATEMENT OF SUBCOMMITTEE CHAIRMAN MO BROOKS

Good morning. I want to welcome everyone this morning to the Subcommittee on Research and Science Education field hearing, "STEM Education in Action: Local Schools, Non-Profits, and Businesses Doing Their Part to Secure America's Future." It is a privilege to be with you to highlight and discuss local STEM education programs and partnerships and to examine their impact on the next generation of STEM professionals, local jobs, and the U.S. economy.

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Tennessee Valley businesses and top-of-the-line schools and research institutions give our citizens high-tech education and employment opportunities as good as any offered in America.

As such, North Alabama is an ideal place to promote science, technology, engineering, and mathematics—or STEM—education, and it is my hope that our district can serve as a model for the rest of America in this regard.

As you may know, our Subcommittee has jurisdiction of essentially all non-defense and non-medical research and development activities of the Nation. This includes oversight of agencies like NASA; the Department of Energy's Office of Science; the National Oceanic and Atmospheric Administration, which includes the National Weather Service; portions of the Department of Homeland Security; the National Institute of Standards and Technology; and the National Science Foundation, which provides approximately 40 percent of all non-medical basic research at American colleges and universities, including support for STEM education.

The research these agencies fund is important to our Nation's economic success, but at the same time, it is also critical to note that America faces unsustainable budget deficits that constitute our greatest economic and national security threat. By way of emphasis, Admiral Mike Mullen, Chairman of the Joint Chiefs of Staff, testified before the House Armed Services Committee last year that our Nation's biggest national security threat is our deficit.

Mr. Lipinski and I may disagree on certain policy issues, but I am confident he would agree with me that we must do more to alleviate our deficit. Likewise, I am sure he would agree with me that an essential element of future U.S. economic prosperity is a competent, skilled workforce—one that we cannot achieve without strong STEM education efforts, particularly on the local level.

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Also noteworthy are the efforts of other local schools and organizations not testifying before us today. For example, this Subcommittee had the privilege of hosting

Christine Sutton, a teacher at Grissom High School in DC, last year to discuss Grissom's robust cybersecurity curriculum. In addition, Aerojet, through the GenCorp Foundation, is strongly committed to STEM education in the Huntsville community.

Our commitment to STEM education is exemplified by contributions to STEM programs in the community by the University of Alabama-Huntsville's Propulsion Research Center and related scholarships and the U.S. Space and Rocket Center's summer camp, as well as many other local initiatives supporting STEM programs for students ranging from elementary through high school.

I could cite numerous other examples, but it is clear that STEM education is a top priority for many in our area. I am proud of what this community has been able to accomplish and look forward to learning more about these remarkable initiatives. Thank you all again for joining us today.

Thank you all again for joining us today, and at this time the Chair recognizes Mr. Lipinski of the great State of Illinois for an opening statement.

Mr. LIPINSKI. Thank you, Chairman Brooks.

I thank the witnesses for being here today. I thank Bob Jones High School for hosting us and everyone who has come here to hear about this critical issue for our country.

I am very happy to be down here. I came down on Saturday. I actually went to the—my wife came with me, went to Space and Rocket Center on Saturday. We enjoyed our visit there, going through the Wernher von Braun, the history of his biography, the history of the great things that he did for our nation. I have my "What Would Wernher von Braun Do?" bracelet that I have on here with me right now.

I got to land a space shuttle at space camp, and I enjoyed that very much, and all of that is a very important part of STEM education.

But I want to thank Chairman Brooks for holding this hearing. You would probably be surprised at how much we—yes, there are things that we disagree on policywise, but for a Chicago Democrat, you might be surprised how much I agree with many things with Chairman Brooks, although that might not be a good thing for me to say down here for him.

Actually, I am not your typical Chicago Democrat. We will just say that. We will leave it at that.

My background is in STEM education, I have two degrees in engineering. My wife has a degree in math. I have served as the Co-Chair of the House STEM Ed Caucus for the past six years. So I am very happy that Chairman Brooks has made it a priority to emphasize STEM education and what can we do for STEM ed in our country.

It is alarming that so many American students perform poorly in science and math. On the most recent National Assessment of Educational Performance, only 21 percent of high school seniors performed at or above the proficient level in science. When compared internationally, our student performance is even more alarming. In the most recent Program for International Student Assessment administered to 15-year-olds, the U.S. ranked 17th in science and 25th in math out of 34 countries surveyed.

Poor performance in science and math not only limits the students' job opportunities, but taken together, the poor performance of so many of our students is also the first in a series of falling dominoes that are dulling our Nation's competitive edge in tech-

nology and innovation. The lack of a strong K–12 foundation in STEM disciplines is a major factor in the high attrition rates in STEM subjects at the post-secondary level as well.

Fewer than 40 percent of students who state as college freshman that they want to major in a STEM discipline actually end up receiving a Bachelor's degree in their desired field. That is 3 out of 5 who do not follow through, do not make it all the way through college to get the Bachelor's degree. This, in turn, is creating a shortage in the supply of skilled workers, the demand for which will grow rapidly in the coming decades.

At the same time, other countries are seeing an increase in the number of students receiving degrees in STEM fields and preparing for the high-tech jobs that will shape the global economy in the 21st Century.

These two factors are placing the United States in a position from which we could very easily lose our historical advantage in innovation and technology, possibly within our lifetimes. I know there is no silver bullet that will solve this problem and that we need to attack the STEM education crisis from multiple angles using a number of strategies.

That is why I am pleased that we have a panel of witnesses that represent significant stages of the STEM pipeline—high schools, community colleges, four-year universities, non-profits, and industry.

I already mentioned the importance of a quality K–12 education in STEM. I also want to mention about how community colleges play a vital role in preparing students for highly technical jobs upon graduation. In addition, community colleges can provide a pathway for students in STEM fields in our Nation's world-class universities, such as the University of Alabama-Huntsville.

One other area of STEM education, as I mentioned earlier, is informal STEM education, STEM ed that takes place outside of the classroom. This was always something very important to me growing up. We had some great museums in Chicago, especially the Museum of Science and Industry. That really helped to spur my interest and get me excited and want to pursue engineering. As I mentioned, space camp is certainly a place where this takes place and gets kids interested in pursuing a STEM field in science, technology, engineering, math.

So right now, the strain is being placed on U.S. companies and non-profit research institutions that rely on students with STEM degrees, on getting students with STEM degrees. Our nation's deficiency in STEM education is making it increasingly difficult to fill vital positions.

So I look forward to hearing from everyone on our panel about what you perceive to be the problems and the potential solutions from your unique vantage points. I think it is a great panel that has been put together here to really hit from all these different angles about what we can do about STEM education.

As I said, I know there is no silver bullet, but that does not mean that we should not be doing all that we can in making sure something that I think is very important, having public-private partnerships. We really need to get the private sector involved, but always

education will be a very critical public priority and a priority for our government and for elected officials.

So with that, I yield back.

[The prepared statement of Ranking Member Daniel Lipinski follows.]

PREPARED STATEMENT OF RANKING MEMBER DANIEL LIPINSKI

Thank you, Chairman Brooks, for holding this hearing, and I'd like to thank the witnesses as well for being here today. I'm delighted to be here in Madison to discuss an issue that is not only of great importance to our Nation and our ability to compete in the 21st century global economy, but it is also one that is of particular interest to me. As a former engineer, I understand all too well how much better we need to do in STEM education, and I am glad that the Subcommittee continues to make improving the teaching and learning of STEM disciplines at all levels a top priority.

It's alarming that so many American students perform poorly in science and math. In the most recent National Assessment of Educational Performance, only 21 percent of high school seniors performed at or above the "proficient" level in science. When compared internationally, our students' performance is equally alarming. In the most recent Program for International Student Assessment administered to 15-year-olds, the U.S. ranked 17th in science and 25th in math out of 34 surveyed countries.

Poor performance such as this is the first in a series of falling dominoes that are dulling our competitive edge in innovation and technology internationally. The lack of a strong K-12 foundation in STEM disciplines is a major factor in the high attrition rates in STEM subjects at the postsecondary level as well. Fewer than 40 percent of students who state as college freshmen that they want to major in a STEM discipline actually end up receiving a bachelor's degree in their desired field. This, in turn, is creating a shortage in the supply of highly skilled workers, the demand for which will grow exponentially in the coming decades. At the same time, other countries are seeing an increase in the number of students receiving degrees in STEM fields and preparing for the high-tech jobs that will shape the global economy in the 21st century. These two factors are placing the U.S. in a position in which we could very easily lose our historical advantage in innovation and technology, possibly within our lifetimes.

I know there is no silver bullet that will solve this problem and that we need to attack the STEM education crisis from multiple angles using a number of strategies. That is why I'm pleased to have a panel of witnesses that represents significant stages of the STEM pipeline: high schools, community colleges, four-year universities, non-profits, and industry. I already mentioned the importance of a quality K-12 education in STEM. Community colleges also play a vital role in preparing students for highly technical jobs upon graduation. In addition, community colleges can provide a pathway to pursuing STEM fields at our Nation's world-class universities, such as the University of Alabama in Huntsville.

Finally, I'm aware of the strain that is being placed upon U.S. companies and non-profit research institutions that rely on students with STEM degrees. Our Nation's deficiencies in STEM education are making it increasingly difficult to fill vital positions. I look forward to hearing from each of you about what you perceive to be the problems, and potential solutions, from your unique vantage points. And with that, I yield back.

Chairman BROOKS. Thank you, Mr. Lipinski.

I also want to thank the Space and Rocket Center and Dr. von Hart for treating Dan to such a swell visit at the Space and Rocket Center. We were also able to get him to jog about six or seven miles yesterday on Auburn Street down in South Huntsville. He tells me he is not used to the southern heat. We have plenty of that this year if you want any up north. A visit down to Alabama would not be complete if my wife and I did not take him to Greenland Barbecue. So welcome to Greenland. You won't get barbecue like that up north.

Mr. LIPINSKI. That is some of the best barbecue I have ever had. I would just say, I lived in Durham, North Carolina, for seven years, so I do know barbecue.

Chairman BROOKS. That having all been said, if there are other Members of Congress on the Subcommittee who wish to submit additional opening statements, their statements will be added to the record at this point. Now I would like to introduce the witnesses for today's Research and Science Education Subcommittee hearing.

Our first witness is Dr. Camille H. Wright, who is the Director of Secondary Curriculum and Instruction for Madison City Schools. Dr. Wright has worked in public education for over 28 years, ranging from the classroom to the administrator.

Our second witness is Dr. Robert A. Altenkirch, the President of the University of Alabama in Huntsville. Prior to his appointment, he served as President of New Jersey's Institute of Technology for nine years, as well as a number of other universities and faculty.

As an aside, I have a little bit of fondness for UAH. My wife went there and was Math Student of the Year, after having gone to that other university in Tuscaloosa that is better known for football, where she got a CPA or accounting degree, but also got a math degree and was a math teacher involved in the STEM fields, and she was able to do that because of UAH. Now my son is there seeking a Master's in the engineering school. So please be kind to him, Dr. Altenkirch, if you get the chance.

Our third witness is Dr. Marilyn C. Beck, the President of Calhoun Community College. Before coming to Calhoun, where she was the first female president, she also served 15 years at Lord Fairfax Community College in Virginia, where she was also the first female president, and I am sure you are going to share with us a lot of interesting things about Calhoun, the campus, along with the robotics facility that is right across the street. That is a wonderful addition to the Tennessee Valley.

Our fourth witness is Dr. Neil Lamb, the Director of Educational Outreach for the HudsonAlpha Institute for Guided Technology. Dr. Lamb formerly served as Director of Education in the Department of Human Genetics at Emory, and HudsonAlpha is a wonderful, different kind of addition to our high-tech community. So thank you so much for being here, Mr. Lamb.

And our final witness is Mr. Andrew Partynski, the Chief Technology Officer for the Science Applications International Corporation, Assistant in Technology Solutions Business Unit, more commonly known as SAIC, their acronym. Prior to SAIC, Mr. Partynski worked for DOS Technologies, where he served as President for Homeland Security and Defense for the C41 sublet.

As our witnesses should know, spoken testimony is limited to five minutes, after which the Members of the Subcommittee will ask questions. I might be a little bit lax on that five-minute rule. Traditionally in Washington, we are not so lax. So please understand there will be a little bit of leeway, but if you start acting like United States Senators with a filibuster, I might have to shorten things just a little bit to try to get it back under control, since we in the House of Commons, as opposed to the House of Lords, we tend to be brief. I remember my first speech on the House Floor

was 120 seconds. But we are not demanding that kind of brevity from you.

With that having been said, I now recognize our first witness, Dr. Wright, for five minutes.

**STATEMENT OF DR. CAMILLE H. WRIGHT,
DIRECTOR OF SECONDARY EDUCATION,
MADISON CITY SCHOOLS**

Dr. WRIGHT. Thank you. Chairman Brooks and Ranking Member Lipinski, Members of the Subcommittee on Research and Science. My name is Camille Wright, Director of Instruction for Madison City Schools. Welcome to Bob Jones High School. Thank you for inviting me to participate in this important hearing to discuss STEM education programs and partnerships in Madison City and its importance to the future workforce in Alabama and the U.S. economy.

STEM education is critical to the future of our nation's economy. The mastery of STEM subjects is a vital component in being able to successfully navigate the 21st century global environment. This goes far beyond being a scientist, a physician, an architect or an engineer. Understanding the world in which we live and how to make critical decisions relies on a base in science, engineering, and mathematics. Certainly in our technology-driven society, students need to be comfortable interacting with and utilizing technology, and their ability to secure high-wage, high-demand jobs and maintain those jobs depends on this.

Madison City School System places a strong emphasis on STEM education. We are sitting in the Mecca of STEM careers. Eighty-eight percent of Madison City graduates enroll in post-secondary. They are more likely to go into a STEM field than any other occupation. It is important that we use all our available resources in the area to keep our STEM education relevant and rigorous.

Madison City Schools offers a vast array of courses, clubs, and after-school activities in the STEM fields. We offer nine Advanced Placement courses just in science, technology and mathematics. About 35 percent of our students take an advanced placement course. We have over 90 percent of our graduates with a career and technical education course. Our state-recognized Career and Technical Education programs in the STEM fields include engineering, biomedical sciences, health science, and computer science.

In most of these career and technical education programs, the terminating course includes some type of internship in the field. For example, in our Level Three Engineering this year, we had about 60 students that interned in businesses such as Boeing, Adtran, Aegis, AMTEC, SAIC, Raytheon, HudsonAlpha, NASA, and many other companies. In the STEM areas, we have a 100 percent placement rate at the post-secondary level. Additionally, our engineering teacher has received the national Milken Award for educational excellence.

In every elementary and middle school in Madison City that is an AMSTIS school or an Alabama Math, Science, and Technology Initiative school, we use an integrated philosophy to teaching the STEM courses. Research shows that students learn better when

they think, when they plan, reason, compute, and evaluate as a means to solve problems in order to learn the content.

One of the greatest limitations to high student achievement in the STEM areas, though, is the level of knowledge of the classroom teacher. Whether it is due to a lack of content knowledge, a lack of understanding of real-world application, or a lack of knowledge of the available resources, the classroom teacher is the key to improving achievement in the STEM fields. In fact, in the book *Team to Teach*, author and educator Anne Jolly states that the single most important factor in improving student achievement is the classroom teacher. If we want to improve K–12 math and science education, we have to invest in our educators.

Alabama has largely adopted the National Common Core Standards. We need new resources for our teachers to align to the Alabama College and Career Ready Standards. However, this year the state legislature will likely fund textbooks at only \$35 per child, even though an average cost of a textbook is about \$75. Teacher professional development money has been cut as well. This is money that we have used in the past to help our teachers become knowledgeable of best practices, current research, and the industry standards.

In order to maintain student interest in math and science, we have to show the linkage between the concepts taught in school and their application to life. For too long, our students have viewed science as just a set of facts that does not apply to their daily routines. So connecting to health, to food, to their environment is critical to answering their question, “Why do we need to know this?”

In a Southern Region Educational Board report, “New Vision for the Middle Grades,” they state, “Recent evidence makes clear that each middle grader’s personal, individual engagement in school is essential to their success.” Studies repeatedly show that students who lose interest in school in the middle grades are likely to flounder in the ninth grade and then drop out. Yet developmental and brain research confirms that by the middle grades, students are capable of making these connections between their academic work, their personal interests, and their career aptitudes. Middle-grade professionals can use these connections to help students prepare for high school and post-secondary studies.

If we can connect what they are learning in math and science and use their natural affinity and love of technology to make their learning relevant to their world, we can keep students’ love of STEM alive throughout their educational career. Additionally, they need participation in programs such as rocketry and robotics competitions, Destination Imagination programs, science fairs that truly focus on scientific investigation and have real-world, hands-on learning opportunities in the community, much like we are doing with our career and technical education programs.

In order to maintain our current level of excellence, it is critical to Madison City to have partnerships with post-secondary, business and industry, and non-profit organizations. We partner with local colleges and universities, those at the table, in a multitude of ways. In addition to dual enrollment and articulated credit, post-secondary institutions in our area provide competitions, they provide transitional outreach, and have summer camps in the STEM areas.

Our partnerships with business and industry are extensive. The business community funds a wide variety of programs in our schools. They provide guest speakers, job shadowing opportunities, and internships that I previously talked about. Organizations such as HudsonAlpha offer free professional development to our teachers and educational experiences to our students.

We also partner with a number of non-profit organizations that provide a wide variety of services, from counseling to professional development. One of the most notable is the Alabama Best Practice Center. This organization has provided hundreds of hours of training, free training, for our district.

In our global, rapidly changing world, the most important gift we can give our students is the understanding of the need to be a lifelong learner. Our education doesn't stop once we have a diploma in hand. In today's fast-paced world, so many of our jobs that our students will hold, we know they don't exist. This means that our students must exit high school with the ability to think, to collaborate, to make decisions, and to innovate, all those skills that they gain in the STEM areas.

The basic skills are still important, but our students must be able to use those skills as a foundation, not as an end point. It is important to develop a culture that embraces the community of learning from the schools to the family, to industry, throughout the community. This is an area of great strength for the Huntsville/Madison City/Madison County area, and we place a premium on education and lifelong learning.

Thank you.

[The prepared statement of Dr. Wright follows:]



Madison City Schools Congressional Field Hearing

STEM Education in Madison City Schools April 30, 2012

Greetings, Chairman Brooks and Ranking Member Lipinski, my name is Camille Wright, Director of Instruction for Madison City Schools. Welcome to Bob Jones High School. Thank you for inviting me to participate in this important hearing to discuss STEM education programs and partnerships in Madison City and its importance to the future workforce in Alabama and the US economy.

STEM education is critical to the future of our nation's economy. The mastery of STEM subjects is a vital component in being able to successfully navigate the 21st century global environment. This goes far beyond being a scientist, physician, architect or engineer. Understanding the world in which we live and how to make critical decisions relies on a base in science, engineering and math. Certainly in our technology-driven society, students need to be comfortable interacting with and utilizing technology, and their ability to secure high-wage, high-demand jobs and maintain those jobs depend on this.

Madison City School system places a strong emphasis on STEM education. We are sitting in the Mecca of STEM careers. Although we have a very transient population, the greater Huntsville area has the largest population of master's degrees in the nation and the second largest population of individuals with doctorate degrees. Eighty-eight percent of Madison City Schools' graduates enroll in post secondary. They are more likely to go into a STEM field than any other occupation except education. It is important that we use all the available resources in our area to keep our STEM education relevant and rigorous.

Madison City Schools offers a vast array of courses, clubs, and after school activities in the STEM fields. We offer nine Advanced Placement courses in Science, Technology and Mathematics. About 35% of our students take an Advance Placement course. We have over 90% of our students graduate with a Career and Technical Education course. Our state recognized Career and Technical programs in the STEM fields include Engineering, Biomedical Sciences, Health Science, and Computer Science. In most of these Career and Technical Education programs, the terminating course includes some type of internship in the field. In Level 3 Engineering this year we have had approximately 60 students interning in business such as Boeing, Adtran, AEGIS, AMTEC, SAIC, Raytheon, Hudson Alpha, NASA, and many other companies. In the STEM areas, we have a 100% placement rate at the post secondary level. Additionally, our Engineering teacher has received the national Milken Award for educational excellence.

At every elementary and middle level, every school is an Alabama Math, Science, and Technology Initiative school. We use an integrated philosophy to teaching STEM courses. Research shows that students learn better when they think, plan, reason, compute and evaluate as a means to solve problems in order to master the content. We use iPads for part of our tutoring program that is funded

through a state Department of Defense grant. Our district technology coach works closely with our teachers to help them effectively integrate technology skills.

One of the greatest limitations to high student achievement in the STEM courses is the level of knowledge of the classroom teacher. Whether it is due to lack of content knowledge, lack of understanding of real-world application, or lack of knowledge of resources, the classroom teacher is the key to improving student achievement in STEM fields. In fact, author and educator Anne Jolly, in her article, "What Does the Research Say?", states that "the most important determinant in student achievement is teacher knowledge and expertise". If we want to improve K-12th grade math and science education, we have to invest in our educators.

Alabama has largely adopted the National Common Core Standards. We need new resources for our teachers to align to the College and Career Ready Standards. However, this year the state legislature will likely fund textbooks at only \$31 dollars per child even though an average textbook cost about \$75 dollars. Teacher professional development money has been cut as well. This is money we have used in the past to help our teachers become knowledgeable of best practice, current research, and industry standards.

One of the components that Madison City has found most effective is instructional coaches. Our Board of Education has funded instructional coaches for each of the secondary school. All of our elementary schools have reading coaches that are funded through the Alabama Reading Initiative. These teachers' primary responsibility is helping their peers develop effective instructional practices and increase student achievement. They are a point of resource for their colleagues. The other critical factor that has helped Madison City Schools has been our partnerships with business, industry, and non-profit organizations.

In order to maintain student interest in math and science, we have to show the linkages between the concepts taught in school and its application to life. For too long students have viewed science as a set of historical facts that does not apply to their daily routines. Connecting to health, food, and their environment is critical to answering their question, "Why do we have to know this?" In a Southern Regional Educational Board report, *New Vision for the Middle Grades*, they stated, "Recent evidence makes clear that each middle grader's personal individual engagement in school is essential to his or her success. Studies repeatedly show that students who lose interest in school in the middle grades are likely to flounder in ninth grade and later drop-out. Yet developmental and brain research confirms that by middle grades, students are capable of making connections between their academic work, their personal interests and career aptitudes. Middle grades professionals can use these connections to help students prepare for success in high school and postsecondary studies." (p. 1)

If we can connect what the students are learning in math and science and use their natural affinity and love of technology to make learning relevant to their world, we can keep students love of STEM alive throughout their educational career. Additionally, they need participation in programs such as rocketry and robotics competitions, Destination Imagination programs, science fairs that truly focus on scientific investigation, and have real world hand-on learning opportunities in the community.

The biggest challenges we face in improving student achievement in math and science education is keeping teachers knowledgeable and relevant in their field and having the needed technology to be

current. We need to show students how STEM is used in everyday life and why it is important to tomorrow's careers. This goes beyond simply saying "science and math are important - study hard". We need to show students where these skills get used and how STEM proficiency helps them land a better paying job. A recent STEM study showed that students who were STEM proficient had higher pay than that of non-STEM students - even when the STEM proficient students were working outside STEM career fields. The industries surveyed noted that students with strong STEM skills were better able to think critically and evaluate the evidence when making key decisions. Students need to hear repeatedly from industry that "We hire employees who have skill sets that are in line with STEM."

Madison City could not maintain excellence without all of our partnerships with post-secondary, business and industry, and non-profit organizations. We partner with local colleges and universities in a multitude of ways. In addition to dual enrollment and articulated credit, post-secondary institutions in our area host competitions, provide transitional outreach, and have summer camps for STEM areas. Our partnerships with business and industry are extensive. The business community funds a wide variety of programs in our schools. They provide guest speakers, job shadowing opportunities, and internships. We have an advisory committee from business and industry that helps guide the direction of programs in Madison City to keep us relevant and in touch with industry standards and needs. Organizations such as Hudson Alpha offer free professional development to our teachers and educational experiences for our students.

We partner with numerous non-profit organizations that provide a variety of services from counseling to professional development. One of the most notable is the Alabama Best Practice Center. This organization has provided hundreds of hours of training for our teachers, administrators, and central office staff and has help with the vertical alignment of educator training. This year, we participated in the initial year of the Instructional Partner Pilot Program; a joint effort between Alabama Best Practices Center, the State Dept of Education, Alabama Reading Initiative, and Alabama Math, Science, and Technology Initiative along with 5 select school systems in our State. This program has provided in depth support for our principals and instructional coaches by implementing research-based best practices in adult learning and peer coaching. This approach develops teacher leaders that transform the way in which instruction is delivered in the classroom. The Instructional Partner Pilot is an impetus in the development of professional learning communities in our schools. As director of Instruction a large part of my job is to develop and coordinate the outreach to these entities.

In our global, rapidly changing world the most important gift we can give our students is the understanding of the need to remain a lifelong learner. Our education doesn't stop once we have a diploma in our hand. In today's fast-paced world, so many of the jobs our students will hold don't currently even exist. This means that our students need to exit high school with the ability to think, collaborate, make decisions and innovate. The basic skills (the three R's) are still important, but our students need to be able to use those skills as a foundation, not as the end point. It is important to develop a culture that embraces the concept "community of learning" from the schools, to the family, to industry and throughout the community. This is an area of great strength for Huntsville/Madison/Madison County. We place a premium on education and lifelong learning.

Chairman BROOKS. Thank you, Dr. Wright.
The Chair next recognizes Dr. Altenkirch for five minutes.

**STATEMENT OF DR. ROBERT A. ALTENKIRCH,
PRESIDENT, UNIVERSITY OF ALABAMA-HUNTSVILLE**

Dr. ALTENKIRCH. Thank you, Congressman. I want to thank the Members of the Subcommittee on Research and Science Education for this opportunity to address them, for your service, and also your interest in our area of STEM education and to see it in action.

The University of Alabama in Huntsville is a top-tier national research university as ranked by *U.S. News & World Report*, and we have achieved the highest classification in research activity by the standards established by the Carnegie Foundation for the Advancement of Teaching. Our campus serves as the anchor tenant of Cummings Research Park, the second largest university-related research park in the United States, with nearly 300 companies and 25,000 employees. Adjacent to Cummings Research Park is the Redstone Arsenal, where NASA's Marshall Space Flight Center and several U.S. Army laboratories and commands are located.

So it is in this environment that we find ourselves in the center of workforce development that is heavily dependent on research, technology, science, engineering and mathematics. So it is obvious that the success of this community and the success of the federal agencies at the Redstone Arsenal in addressing their missions, and the success of corporations located here to support the Army and NASA are heavily dependent on creating a pipeline of intellectual and creative talent in the so-called STEM fields.

Last year our campus supplied the local workforce with more than 630 graduates possessing degrees of a technical nature. Nearly half of the graduates earned a degree in science or engineering. We are the single largest contributor of professional degrees for the STEM workforce in the greater Huntsville area.

We recognize the need for our university to provide leadership in promoting STEM education and create a pipeline of intellectual and creative talent, and we take this responsibility seriously. We have made a lot of strides in teaching the teachers in STEM education. Our campus was the pilot site for the AMSTI program that Dr. Wright mentioned, the Alabama Math, Science, and Technology Initiative. A recent multi-year study by the U.S. Department of Education credited AMSTI with providing the equivalency of an additional 28 days of traditional classroom instruction per year.

AMSTI is a program for elementary and middle school teachers, implementing hands-on or inquiry-based learning in classrooms. During the past five years, we have trained more than 4,000 teachers and have had an impact on more than 120,000 students. AMSTI schools out-perform non-AMSTI schools in middle-grade science, math, and reading significantly. The percentile rank difference on the SAT-10 math test between schools that adopted AMSTI and a control group increased from three percentile points to eight percentile points from Grade six to eight, and from three to nine percentile points in reading.

This summer at UAH marks the beginning of a new Master's degree in STEM education, the Master of Science in Integrated

Science Technology, Engineering and Mathematics. This program is targeted at in-service secondary school science and math educators, seeks to advance their content knowledge and command of subject matter, which in turn have been proven to impact student learning positively in the STEM areas. It is the only program of its nature in Alabama and one of only three in the Southeastern United States.

We are working with local corporations on a middle school through high school STEM pipeline aimed at, one, engaging students in STEM activities during a two-week summer science and engineering camp at the critical time before eighth grade, where research shows that interest in STEM disciplines suffers a precipitous decline; two, keeping them engaged in STEM activities, education and career opportunities throughout the academic year; three, sustaining both the summer camp and academic year experience in subsequent years through Grade 11, and this pipeline culminates with their admission to UAH in a STEM major.

We are also using the Innovative Systems Project for increased recruitment of emerging STEM students or InSPIRESS, which is an outreach activity that engages high school students in an open-ended design activity that piques their interest and gives them a better understanding of what scientists and engineers do.

The University of Alabama in Huntsville also provides leadership as the regional coordinator for 10 North Alabama high schools to better prepare Alabama students for engineering careers through the Alabama Engineering Academy Initiative. These academies are embedded in high schools and provide specific, multi-year curricula geared toward prospective engineering students.

Once they enroll as students on our campus, we prepare our engineering students for transition to the workforce by having them work in teams to solve large-scale systems problems for real-world applications. Also, our cooperative education program is one of the largest in the Southeastern United States, and partners with scores of local companies and government agencies to give experience to students in the workforce.

So each of these steps helps prepare students for a robust education at UA-Huntsville and for preparation for their lives after being a student, and helps them add value to their employer from the first day they walk in the door.

Thank you very much.

[The prepared statement of Dr. Altenkirch follows:]



U.S. House of Representatives

Committee on Science, Space, and Technology
Subcommittee on Research and Science Education

*STEM Education in Action: Local Schools, Non-Profits
and Businesses Doing Their Part to Secure America's Future*

Monday, April 30, 2012 – 10 a.m.
Bob Jones High School, Madison, Alabama

Testimony of Dr. Robert A. Altенkirch
President, The University of Alabama in Huntsville

_) What role does your institution play in helping the U.S. economy? Please discuss the role of your institution in providing a skilled workforce to the local and regional economy, particularly with regard to STEM fields.

Our campus plays an important role in critical areas for the United States, most notably in America's national security and the exploration of space. However, UAHuntsville has also emerged as a national leader in the understanding of Earth science, particularly as it relates to severe weather and global climate change. And, while aeronomy may be an esoteric topic, our world-renowned research in astrophysics and heliophysics are creating solutions for the significant, and often disruptive, impact of solar activity on the planet.

The University of Alabama in Huntsville is a Tier 1 national university as ranked by U.S. News & World Report, and we have achieved the highest rank in research activity by standards established by the Carnegie Foundation for Teaching. Our campus serves as the anchor tenant of Cummings Research Park, the second largest university-related research park in the United States with nearly 300 companies and 25,000 employees. Redstone Arsenal is nearby, where NASA's Marshall Space Flight Center and several U.S. Army research laboratories and commands are located.

It is this environment in that we find ourselves in the vortex of workforce development that is heavily dependent upon research, technology, science, engineering and mathematics.

At The University of Alabama in Huntsville, our students, faculty, and staff are engaged in the pursuit of new knowledge, and the creative application of that new knowledge, to solve critical challenges facing our nation. Progress in solving these critical challenges is essential to the future security, vitality, and future of the United States. We believe the solutions to these challenges are derived through STEM activities at the highest level.

Last year, we supplied the greater Huntsville area with more than 630 graduates possessing degrees of a technical nature. Nearly half of our graduates earn a degree in science or engineering, so we are the single largest contributor of professional degrees in growing the regional STEM workforce.

Also, our institution prepares elementary and secondary teachers who, in turn, prepare the future workforce for the local and regional economy. With regard to STEM disciplines, the Department of Education prepares both math and science teachers, and we take an integrative approach to elementary education, making sure future teachers teach children that science, technology, engineering, and math are integrated and not distinct entities.

2) How do you partner and collaborate with local businesses, non-profits, other schools and institutions of higher learning, and local and state government to create an educated and skilled workforce?

Engagement of students entering the workforce, as well as engagement of life-long learners already in the workforce within these research and academic lines of inquiry helps build - and more importantly helps maintain - a strong and educated workforce that can bring value to our society.

The University of Alabama in Huntsville has lengthy, established relationships with numerous companies, and government agencies as well as regional school systems, colleges and universities that are helping to create a graduate that is ready to step into the workforce and begin making immediate contributions.

Our cooperation education program is one of the largest in the southeastern United States with approximately 650 participating students, primarily in science and engineering, but business and health care also play an increasingly important role in this program. This program consists of students who are working at an area company or government agency to get actual work experience in the workplace for a semester, and then returning to the campus for the next semester to receive classroom instruction and hands-on laboratory experience.

Through our Integrated Product Teams (IPT) program we are preparing senior engineering students to transition to the workforce by having them work as a team to solve a large-scale systems design project. We are also using the Innovative System Project for the Increased Recruitment of Emerging STEM Students

(InSPIRESS) program as an outreach activity that engages high school students in an open ended design activity that engages their interest, excites their imagination, and gives them a better understanding of what scientists and engineers do. This also increases their interest in science and engineering careers as well as helping them develop more realistic views of what it takes to be a scientist or engineer (i.e., you don't have to be a genius to be an engineer, there is more to engineering than just calculations, etc.).

The Integrated Product Team program has grown tremendously during the last several years through the strong support of the U.S. Army and NASA's Marshall Space Flight Center. It is a unique engineering senior design experience that engages UAHuntsville seniors in mechanical and aerospace engineering and industrial engineering. The college portion of the IPT program consists of about 80 students from our campus along with students from the College of Charleston and ESTACA (Ecole Supérieure des Techniques Aéronautiques et de Construction Automobile in Paris, France). These college teams compete to be selected as the best design of a project conceived by the Army or NASA.

The high school component of the IPT program (InSPIRESS) will include 240 students in the spring 2012 semester. Those students are divided among 30 teams from 12 high schools from across North Alabama and have been asked to design a science payload to be included in the spacecraft designed by the UAH students. The participating high schools include: Sparkman, Bob Jones, Scottsboro, West Point, Cold Springs, Good Hope, Albertville, Austin, and Lee high schools from Alabama.

Federal agencies, local organizations and companies are very supportive of both these programs by serving as mentors for the teams and by serving as judges for the various evaluation events and boards throughout the semester.

The university's Institute for Science Education and AEGIS Technologies are working on a comprehensive middle school-through-high school STEM pipeline, aimed at 1) engaging students in STEM activities during a two-week summer science and engineering camp at the critical time before 8th-grade, where research has shown interest in STEM disciplines suffers a precipitous decline; 2) keeping them engaged in STEM activities, education, and career opportunities throughout the academic year; 3) sustaining both the summer camp and academic year experiences in subsequent years through grade 11. This pipeline culminates in their admission to a UAH STEM major.

The university's Department of Education collaborated with The Schools Foundation to conduct more than 100 meetings during a six-month span to improve education in all three school systems as part of their SPEAK UP! campaign. The department is also engaged with the Huntsville City Schools on a "Paving the Way" grant from the Department of Defense to work with secondary mathematics teachers to incorporate project-based learning in their classrooms.

The University of Alabama in Huntsville is expanding opportunities for high school students to become engaged earlier in college curriculum through dual enrollment classes. Area high school students can supplement the classes that are available in their high schools, and earn both high school and college credit for such classes. UAHuntsville has recently established an Early Start program for those high school seniors who will be graduating at the end of their fall semester to enroll in the spring semester on our campus.

The University of Alabama in Huntsville is also providing leadership as the regional coordinator for 10 North Alabama high schools to better prepare Alabama students for engineering careers through the Alabama Engineering Academy Initiative. These academies are embedded in the high schools and provide specific, multi-year curriculum geared toward prospective engineering students.

3) What are the major challenges that limit the performance of students in STEM subjects, particularly in their first two years of post-secondary education? What challenges do you face in retaining students pursuing STEM certificates and degrees? If applicable, please describe how your institution contributes to K-12 STEM education?

This summer marks the beginning of the new MSI-STEM degree program at The University of Alabama in Huntsville — the Master of Science in Integrated Science, Technology, Engineering, and Math (MSI-STEM). This master's degree program is targeted at in-service secondary school science and math educators and seeks to advance their content knowledge and subject-matter command, which in turn have been proven to positively impact student learning in the STEM areas.

MSI-STEM courses will be offered over the summer and on weekends, so as to be accessible to teacher-participants, and will presuppose a level of preparation typical of middle school science or math educators. Content courses will be contextualized to Alabama Course of Study standards, the Next Generation Science Standards (when available), and the highly successful Alabama Math, Science, and Technology Initiative (AMSTI), in order to relate content knowledge directly to the curriculum and academic areas in which the teacher provides instruction (an important factor in teacher motivation and learning).

The national need for such programs was first highlighted in the 2005 National Academies' *Rising Above the Gathering Storm* report, which gave such efforts their highest recommendation for ensuring a STEM-competent workforce in the 21st century. In 2010, this call was reiterated and strengthened in *Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5*. Recently, the National Science Foundation (NSF) has made the establishment of teacher content-knowledge programs a major aim of their Math Science Partnership (MSP) effort, and the U.S. Department of Education's MSP program now lists teacher content knowledge as a prime issue to be addressed in funded activities. There is

no similar program within Alabama, and only three others in the southeastern United States.

One major challenge is the difficulty for many students to engage in higher order thinking skills, the arguable result of more than a decade of federal policy that has forced teachers to dumb down curricula and ignore higher order, critical thinking, which can't be evaluated by current tests. Importantly, in the city of Huntsville, research shows that K-8 teachers are ignoring subjects such as science and engineering because they are not tested. Research shows this is a national trend, especially in less affluent school systems.

This leads to another key challenge in dealing with entering students. Many of them are not prepared for college work. A recently published study by ACT found that only 45 percent of graduating high school students are ready for college work in mathematics and only 30 percent are ready for college work in science. For some ethnic groups the numbers are even lower. This leads to lower retention because many entering students do poorly in college classes and become discouraged.

4) How do you prepare your students to continue with a four-year degree or enter the workforce upon completion of their academic program?

Students at UAHuntsville acquire not only subject matter competence, but also learn critical thinking and problem solving skills that are applicable throughout their careers in graduate study or the workforce.

In order to prepare our senior engineering students for the work force we have them participant in a project-based learning environment that forces them to use their engineering knowledge to solve a real-world problem. We create a realistic environment in which they have a project manager and a leadership team that report to the course instructors – the leadership and their team must determine what tasks need to be accomplished – they know what the deliverables based on the syllabus but they must determine how to complete those deliverables. This two semester experience is forcing them to do the same activities they will be doing when they join the workforce – it also forces them to work as a team, exercise their engineering skills and abilities, and learn to communicate more effectively.

UAHuntsville has several noteworthy programs that help students with their transition from their "first career" as a student, into their "second career" as a professional. These include: "Students Working in Parallel with the Army" program on Redstone Arsenal; immersive research programs in Panama and Germany which engage students in real-world challenges and problem-solving; and opportunities for students to engage as part of professional workforce through conferences and symposia, on campus and around the world.

Each of these steps help prepare the UAHuntsville graduate for life after being a

student, and helps them add value to their employer from the first day they walk in the door.

5) How can we attract, educate, and retain the critical mass of talent necessary to keep the state of Alabama – and the country as a whole – at the forefront of research, development, and groundbreaking advances in science and technology?

We are making great strides in this area by “teaching the teachers” on STEM education. Our campus was the pilot site for the Alabama Math, Science and Technology Initiative. This initiative was created by a NASA grant to UAH. This program has been successful and is now replicated at universities all across the state of Alabama. A recent multi-year study funded by the U.S. Department of Education credited the AMSTI program with providing the equivalency of an additional 28 days of traditional classroom instruction per year.

AMSTI is a program for elementary and middle school teachers, emphasizing the implementation of hands-on or inquiry-based learning in science and math classrooms. Significant teacher professional development is necessary, as they typically have never been exposed to this style of learning and teaching. Training is conducted year round at the UAH Institute for Science Education and offsite at our two-week summer institute. AMSTI provides all classroom materials for a given lesson, in the form of a “module.” These modules are delivered to schools, used in the classrooms, and returned to our campus, where they are refurbished and replenished for the next teacher or school. AMSTI offers units on a wide range of science and math topics, such as climate and weather, geology, energy, force and motion, plants, genetics, and anatomy.

During the past five years, our institute has trained more than 4,000 teachers on inquiry-based education and has had an impact on more than 120,000 students. Our AMSTI schools outperform non-AMSTI schools in middle-grade science and math by more than 5 percent (measured by SAT-10).

Further, there is a need to help our citizens develop a vision for STEM careers. Currently, prospective students have a highly exaggerated view of what it takes to pursue these careers. For example, you have to be a genius, or you have to have gotten A’s in all your math and science classes to pursue careers in a technology field.

At younger ages — elementary and middle school — we need to help students gain a better appreciation of what engineers and scientists do. Outreach efforts by UAH faculty and staff are giving them opportunities throughout their K-12 career to engage in STEM career type activities (design, programming, etc.). This will allow us to develop more integrated approaches and programs that build on one another

so that students can anticipate future activities as they progress into later grades. We also link these programs to university programs in science, technology, engineering, and math so that students can see what the end result is – that is what degree programs they can pursue and what their careers might look like.

Universities in Alabama need to have strong encouragement, rather than discouragement, to recruit out of state students interested in the STEM disciplines. Demographics in Alabama will continue to shrink the pool of Alabama students entering universities to study technology-based disciplines. If we can get the students into Alabama universities, including UAHuntsville, we can educate them and retain them in the state. Our campus has a very good track record in this area. Two out of three of our graduates remain in the greater Huntsville area and three out of four of our alumni remain in Alabama.

We can do this with a two-pronged approach: (1) by increasing the number of students who go to college, develop the deep and broad education and analytical reasoning skills needed to be successful, and (2) since our population of young people in Alabama is not growing as rapidly as it once did, aggressively recruit the best and brightest from other parts of the world so they will relocate here, raise their families here, start new businesses here. Universities have been catalytic in this type of highly educated immigration for generations.

6) How can we ensure that we provide sufficient opportunities to allow students, researchers, educators, and employees to become and remain current and competitive in our rapidly evolving world?

The Congress and the President can work to provide healthy, consistent and sustained funding for America's most important research-based activities — including a strong government-centric space program and national defense. Fundamental research through agencies, such as the National Science Foundation, is critical.

People go where the work is exciting, cutting-edge, and promises opportunity for more than just fulfillment of their basic economic needs. Many of these activities should be based on timescales longer than the election cycle. We must find a way to maintain the focus and advancement of these programs and activities despite the difference in timescales. It fails to serve the national interest when we cannot continue on a path where each election cycle re-opens the conversation of why a particular program must be radically altered - or canceled, perhaps, only because it was the idea of the previous administration or Congress – or to serve the short-term political interests of the person elected, and thereby perpetually forego the longer-term national strategic goals for which the program or activity is required.

We must also be able to better understand that it takes to be competitive in today's

world: 1) What does the “competition” look like (i.e., what can they do?) and 2) What must I/we be able to do to stay abreast of them (i.e., the competition)? Then we must determine ways to motivate people to develop those skills and abilities.

Make education fun and engaging. Embrace technology and some level of creativity (social networking, podcasts, video, gaming) as a means by which everyone can be involved and stay current. I suspect this is less of a problem in society now than it was 20 years ago or more.

Finally, we need to do a better job of helping everyone realize the value and necessity of advanced technical education and the positive impact of research on the community, the economy, and the nation.

Chairman BROOKS. Thank you, Dr. Altenkirch.
Next, the Chair recognizes Dr. Beck for her five minutes.

**STATEMENT OF DR. MARILYN C. BECK,
PRESIDENT, CALHOUN COMMUNITY COLLEGE**

Dr. BECK. I would like to thank Chairman Brooks and Ranking Member Lipinski for inviting me to speak about Calhoun's role in STEM education and preparing our graduates for the challenge of an ever-increasing high-tech workforce.

Community colleges play an important role in the U.S. economy, and Calhoun is a great example. We have more than 450 students with declared majors in pre-engineering, science, or math, and approximately 4,500 students enrolled in various technology programs.

The College is a member of a post-secondary consortium with UA-Huntsville and Alabama A&M University, which allows our students to transfer to one of these universities and, upon graduation, pursue employment with the Missile Defense Agency or other employers that require the same types of knowledge, skills, and abilities.

Calhoun launched the State's first and only associate degree programs in biotechnology and clean energy technology. Biotechnology majors transfer to four-year institutions or immediately enter the workforce as biotechnicians. HudsonAlpha partners with Calhoun by providing scholarships for our students, as well as internships for those who have completed one year in the biotechnology program. Through a \$3.4 million grant awarded by the U.S. Department of Labor, Calhoun created the Alabama Center for Excellence in Clean Energy Technology, the first accredited training center for renewable energy technicians in Alabama.

Calhoun offers short-term training certificates, Associate of Applied Technologies, and Associate of Science degrees, and these classes are offered at the main campus in Decatur and the research campus in Huntsville, and also online through a significant number of distance education and hybrid courses.

The College has many established partnerships in our Workforce Solutions Department, which works very closely with businesses and industries to provide customized, flexible, and cost-effective training to businesses and industries. In return, the College secures feedback, which keeps our technology curriculums on the leading edge.

Calhoun also works with area non-profits and schools, such as Bob Jones High School, and institutions of higher learning. The college received a \$5 million grant from the U.S. Department of Labor. It was referred to as the WIRED program, a regional initiative to develop and strengthen partnerships throughout North Alabama and South-Central Tennessee. A total of 23 counties participated in the project, nine from Tennessee and 14 from Alabama, with 16,021 STEM education students reached through scholarships and training.

A current very successful Regional Workforce Development Council project is the Career Coaches initiative. Calhoun's Career Coaches go out into the middle and high schools and work with

students to help them determine their educational and career goals and to familiarize them with post-secondary educational opportunities in the State. Calhoun and the Alabama Industrial Development and Training Institute are partners in the Alabama Robotics Technology Park Initiative, a one-of-a-kind, state-of-the-art training, research, development, and entrepreneurship park that trains students and incumbent workers in the use of robotics technology ranging from manufacturing to unmanned air vehicles for space and defense. To date, training has been provided for 551 workers and more than 1,856 students, and Committee Members have toured the RTP.

Student retention is a major issue in the Nation. Our retention rate is higher than the national average. However, we must continue to increase retention by providing students with financial aid, tutoring services, open labs, and other forms of support.

Calhoun uses the Statewide Transfer Articulation and Reporting System, known as the STARS system, to ensure that students follow the correct curriculum for transfer to Alabama universities. This system assures the seamless transfer of all credits.

Calhoun prepares students to enter the workforce upon completion of their academic program by encouraging and offering students the opportunity to take exams for nationally recognized industry credentials. In partnership with businesses and industry, Calhoun offers apprenticeships and co-op opportunities for students.

Education and training should be affordable for all students. As we have all seen in the past few years, the days of working for one industry for a lifetime are over. Today's workforce must be willing and able to adapt to the changing needs of industry. Calhoun is excited to have an active role in helping to educate, train, and develop the workforce our region needs to successfully compete in the global marketplace.

[The prepared statement of Dr. Beck follows:]

I would like to thank Chairman Brooks and Ranking Member Lipinski for allowing me the opportunity to speak today about Calhoun Community College's role in STEM Education and helping to prepare our graduates for the challenge of an ever increasing high-tech workforce. It is very important for STEM Education to be readily available to today's college students and the workforce. Calhoun is the largest community college in Alabama and roughly one-half of our students have declared majors in a STEM program, when you consider all of our health care, technology, biotechnology, and pre-engineering majors.

What role does your institution play in helping the U.S. economy? Please discuss the role of your institution in providing a skilled workforce to the local and regional economy, particularly with regard to STEM fields.

Calhoun Community College is a vital part of the local economy and is recognized as one of the region's most successful economic and workforce engines. The College trains incumbent workers, under-employed workers, and future workers for many of the high-tech, high-skilled, and high-wage jobs located in the north Alabama region.

Over the past 10 years, the Huntsville Metro Area has experienced a 21.5% population increase which is expected to continue due to the Base Realignment and Closure and various corporate expansions and relocations to the area. According to the U.S. Census 2010, Huntsville is Alabama's 2nd largest metropolitan area. Area growth is expected to continue through at least 2020.

County	Percentage Growth
HSV/Madison	9%
Athens/Limestone	13%
Decatur/Morgan	5%
Lawrence	0.5%

Source: U.S. Census and Chamber of Commerce Studies

Several key area industry sectors include Aerospace and Defense, Electronics, Research and Technology, Manufacturing, and Life Science. The area's top three employers are the U.S. Army/Redstone Arsenal with 30,000 employees; Huntsville Hospital System with 6,280; and NASA/Marshall Space Flight Center with 6,000. All of the industry sectors mentioned are STEM related employers. In addition, there are approximately 11,000 people employed in the aerospace industry; almost 1,000 people employed in the biotech, biomedical, and pharmaceutical fields; and more than 300 international and domestic corporations involved in the design and production of electronics and computer-related technology.

According to an article in the *TechAmerica Foundation*, December 2010, Huntsville's concentration of High-Tech Workers was 2nd in the Nation only to San Jose's Silicon Valley (December 2010). The Bureau of Labor Statistics *Monthly Labor Review*, May 2011, identifies ninety-seven (97) STEM specific occupations. (Cover, Jones, and Watson, May 2011) Those include computer and mathematical sciences, architecture and engineering, and life and physical sciences. In addition, the most recent issue of the *Community College Journal* states that "STEM-related job openings are expected to grow by 17% between 2008 and 2018, nearly twice that of all other job fields." (Unknown, April/May 2012) To address this increasing demand for skilled workers in STEM-related areas, Calhoun has developed and enhanced a number of programs.

Currently, the College has 450 students who have declared majors in Pre-Engineering, Science, or Math. In addition, approximately 4,500 students are enrolled in the College's Technology programs. Calhoun is involved in a Postsecondary consortium with UA-Huntsville and Alabama A&M University which allows students to transfer from Calhoun to one of the consortium universities and upon graduation pursue employment with the Missile Defense Agency or similar employers.

In 2007, Calhoun launched the state's first and only Associate degree programs in Biotechnology and Clean Energy Technology. Students majoring in Biotechnology transfer to 4-year institutions or immediately enter the workforce as bio-technicians. Hudson-Alpha partners with Calhoun by providing scholarships for our students as well as internships for those who have completed one year in

the biotechnology program. Through a \$3.4 million grant awarded by the U.S. Department of Labor, Calhoun created the Alabama Center for Excellence in Clean Energy Technology, the first accredited training center for renewable energy technology in Alabama, serving as the State's launch pad for renewable energy technicians.

Realizing that many of today's workforce are in need of additional training or skills upgrades, Calhoun offers short-term training certificates, Associate of Applied Technologies, and Associate of Science Degrees. In an effort to meet the needs of students, classes are offered at the main campus located in Tanner (Limestone County) and also at the Huntsville (Madison County) campus on Wynn Drive, and also on-line through a significant number of distance education and hybrid courses.

Calhoun has successfully pursued grants with the National Science Foundation to better equip STEM programs and to offer scholarships to STEM majors. Currently, the College has a grant award of over \$500,000 with the majority going to students in the form of scholarships.

How do you partner and collaborate with local businesses, non-profits, other schools and institutions of higher learning, and local and state government to create an educated and skilled workforce?

Calhoun Community College has an established Workforce Solutions department that works very closely with businesses and industries to provide customized, flexible, cost-effective and convenient training to businesses and industries in north Alabama. This training allows employees to maximize performance and efficiencies keeping industries in the forefront of the global marketplace.

The College also works with area non-profits, schools, and institutions of higher learning. A recent example would be Calhoun's Workforce Innovation in Regional Economic Development (WIRED) project. WIRED was a \$5M project funded by the U.S. Department of Labor. This project was a regional initiative to develop and strengthen partnerships throughout north Alabama and south-central Tennessee. A total of twenty-three counties participated in the project – nine from Tennessee and fourteen from Alabama.

This partnership included five universities, nine two-year colleges, three county school systems, five non-profits, and three local government agencies.

Highlights from the project include:

- 6,554 students educated through Science in Motion
- 3,342 students reached through Junior Achievement expansion
- 4,500 students trained through STEM summer camp activities
- 810 Students, Counselors, and Employers reached through Dream It Do It for technology programs
- 436 STEM scholarships awarded in Undergraduate/Graduate programs
- 251 Dual Enrollment Technology Students received scholarships
- 74 Students trained in A.S. Degree Biotechnology program
- 45 Students received Entrepreneurial Training
- 9 Non-Commissioned Officers enrolled in Engineering programs at UAHuntsville and Calhoun Community College

The majority of the grant funds were used for STEM education, workforce training, and scholarships for students majoring in STEM programs.

Calhoun also has articulation agreements with UAHuntsville, Alabama A&M University, and Athens State University. In addition to these articulation agreements, Calhoun has a reverse agreement with Athens State which increases support for students to complete their associate's degree.

The College works very closely with the Regional Workforce Development Council. A current project is the Career Coaches initiative. With this project, Calhoun and five other community colleges in north Alabama employ Career Coaches to go out into the high schools and work with students to help them determine their educational and career goals. The purpose of the project is not to recruit students to a particular college, but to guide these high school students on the appropriate career path for pursuing their goals.

Calhoun is a full partner with Alabama Industrial Development and Training (AIDT) in the Alabama Robotics Technology Park. This facility is a one-of-a-kind, state-of-the-art training, research/development and entrepreneurship park that

trains students and incumbent workers in the use of current and developing robotics technology. The training ranges from manufacturing work to unmanned air vehicles for space and defense.

In an effort to maintain the most up-to-date course offerings, the College has established advisory committees for each technology related discipline for review of curriculum and to offer suggestions for improvement based on current and anticipated future workforce trends.

What are the major challenges that limit the performance of students in STEM subjects, particularly in their first two years of post-secondary education? What challenges do you face in retaining students pursuing STEM certificates and degrees?

The national Survey of Entering Student Engagement (SENSE) identifies six areas critical to student performance and retention for students entering college. Calhoun administers the SENSE survey each fall and uses the data to ensure effective practices and make improvements when needed. The six critical areas include: (2010)

1. Early Connections with someone at the college;
2. High expectations and aspirations from college faculty and staff;
3. Clear academic plan and pathway that helps students set academic goals;
4. Effective track to college readiness;
5. Engaged learning; and
6. Academic and social support network to obtain information about college services.

The SENSE areas are certainly relevant and applicable to students enrolled in STEM courses. At Calhoun, the lack of preparation for college-level coursework, lack of time management skills to complete required readings/homework assignments, and external work/family obligations causing students to withdraw from courses or not attend class regularly are issues continually being addressed to help students complete certificates or degrees.

Community college students are as diverse as the career paths in science, technology, engineering and math. Recent high school graduates may enter

college with a high ACT score while the non-traditional community college student could be returning to college after working for 10 years and need some remediation in math and English before being prepared for college-level courses. These differences in “college readiness” make it difficult for instructors to teach to all levels of students. Nationally, approximately 60% of students need remediation in English, reading or math.

College survey data indicate that students do not anticipate the number of hours required to complete reading and homework assignments to succeed in challenging courses such as Microbiology, Physics, and Calculus. Since these courses are fundamental to most STEM undergraduate degrees, students who do not pass these courses may have difficulty transferring to a four-year university.

Work/family obligations cause students to withdraw from courses or not attend class regularly. More than half of Calhoun’s students are enrolled part-time (62% Spring 2012 semester) and most are employed at least part-time. Research shows that students who miss class within the first four weeks of the semester are less likely to succeed in the course or complete their college degrees. This data supports the need for early-intervention programs for these students, such as Calhoun’s Retention Office of Academic Development, or the ROADS tutoring program.

Student retention at Calhoun is above the national average. Approximately 75% of our students are retained from fall to spring semester; fall to fall retention rates average around 55% for first-time, full-time freshmen. Many community college students do not have a designated “major” since they are planning to transfer to senior institutions and may be unsure of specific career goals. Designated STEM majors are often challenged by the curriculum as well as knowledge of transferability issues with particular classes. We also find that students may not be aware of academic support services (e.g., free tutoring, labs). Again, the full-time status for students is extremely critical for college completion. It takes a much longer period of time for students to graduate if they are enrolled in only one or two courses each semester.

A very successful initiative the College has implemented in the last few years is the Career Coach Initiative. The primary goal of the Career Coaches

Initiative is to implement a comprehensive career advisement program targeted towards grades 7-12 graders designed to assist these students with their career aspirations, to recognize postsecondary programs that fit their career goals, and to refer those students to programs that will facilitate students' reaching their desired goals. Activities include providing assistance in completing scholarship and college admission applications, providing resources about internship programs, short-term certificate training and other career opportunities, providing one-on-one career coaching including the development of career portfolios, sharing information about career pathways and connecting students to early college programs such as Upward Bound, Tech Prep and Dual Enrollment.

In addition, Calhoun has more than 100 articulation agreements with area high schools for Tech Prep and Dual Enrollment programs. The college also offers an Early College Entrance Program (ECEP) through partnership with local school systems. The College hosts the annual regional BEST Robotics Competition where high school students compete, and summer camps for high school students interested in technology and healthcare are also offered. A camp introducing high school female juniors and seniors to non-traditional programs (electricity and welding) is also offered each summer by the College.

How do you prepare your students to continue with a four-year degree or enter the workforce upon completion of their academic program?

Calhoun prepares student to continue with a four-year degree by having established articulation agreements with UAHuntsville, Alabama A&M University, and Athens State University. Also, Calhoun uses the Statewide Transfer Articulation and Reporting System (STARS) system to ensure students follow the appropriate curriculum for transfer to Alabama universities.

Additionally, Calhoun has a reverse transfer agreement with Athens State University and is currently working to establish the same type of agreement with UAHuntsville. This agreement allows Calhoun students who have transferred prior to graduation the opportunity to earn an Associate Degree by transferring credits back to Calhoun.

Calhoun prepares students to enter the workforce upon completion of their academic program by encouraging and offering students the opportunity to take

exams for nationally recognized industry credentials. In addition, the College offers apprenticeship and co-op opportunities. Many of these students are hired as full-time, permanent employees upon completion of their educational program.

How can we attract, educate, and retain the critical mass of talent necessary to keep the state of Alabama – and the country as a whole – at the forefront of research, development, and groundbreaking advances in science and technology?

In order to attract, educate, and retain critical talent in the state of Alabama and the country as a whole, scholarships should be provided for deserving students at both the two-year and four-year level allow for a seamless transition and to encourage college completion.

Employers should offer incentives to graduates to keep good talent local.

Employers and area Chambers of Commerce need to assist in student recruiting by providing information on desired skills and talents for careers and future workforce needs.

Employers and college faculty should serve as mentors.

More co-op and intern/apprenticeship opportunities are needed.

State-of-the-art labs and equipment are needed for curriculum support to provide hands-on experiences to students majoring in the STEM fields.

More career counseling, assessments, and job placement services are needed to assist students in evaluating and determining a career path and developing the best plan to meet their goals.

How can we ensure that we provide sufficient opportunities to allow students, researchers, educators, and employees to become and remain current and competitive in our rapidly evolving world?

It is very important that students, researchers, educators, and employees become and remain current and competitive in our rapidly evolving world. In an effort to ensure this happens, it is very important to work with trade organizations to keep up with industry standards.

Also, education and training should be affordable for all students. As we have all seen in the past few years, the days of working for one industry for a lifetime are over. Today's workforce must be willing and able to adapt to the changing needs of industry.

Calhoun is excited to have an active role in helping to educate, train and develop the workforce our region needs to successfully compete in the global market place.

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Chairman BROOKS. Thank you, Dr. Beck.
The Chair next recognizes Dr. Lamb for his five minutes.

**STATEMENT OF DR. NEIL LAMB,
DIRECTOR OF EDUCATIONAL OUTREACH,
HUDSONALPHA INSTITUTE**

Dr. LAMB. Good morning, Mr. Chairman and Ranking Member Lipinski. My name is Neil Lamb, and I am the Educational Outreach Director for the HudsonAlpha Institute for Biotechnology here in Huntsville, and I am pleased to be before the Committee today testifying about ways that non-profit organizations can play a role in our nation's STEM education.

As all of you noted, STEM skills are of vital importance to national prosperity, security, and the health of our citizens. The United States has long been a leader in scientific achievement and in using those discoveries for innovation.

With fierce competition for information seeking to overtake our leadership position, sustained national support of STEM education is critical. Industry and non-profit organizations have an important supporting role in nurturing budding scientists and engineering professionals.

HudsonAlpha, a not-for-profit research institute, has a threefold mission of conducting genomics research, sparking economic development, and providing educational outreach.

HudsonAlpha's research faculty use genomics to understand how organisms function at a molecular level in both health and disease. This research takes place under the same roof as more than 20 biotechnology-related companies, demonstrating our belief that proximity between research and industry builds collaboration and moves discovery into commercialization at a faster pace.

Part of the attraction to Huntsville is the culture of innovation and the emphasis on STEM education. This creates those "aha" moments that move research forward and turn ideas into products.

Jim Hudson and Lonnie McMillian, the founders of HudsonAlpha, each created and matured successful businesses here. The opportunity to impact STEM on a broad scale was a driving reason why education is a critical component of the mission of HudsonAlpha.

From an educational point of view, our programs are organized around preparing the future biotechnology workforce and building awareness about the influence of genetics on the lives of all citizens. We partner with educators, policymakers, corporations and civic groups to connect academic learning with real-world application. Our activities are incorporated into middle and high school classrooms across the State. We have school trips to the Institute during the summer months, and we provide summer camps and internship opportunities, as well as professional development workshops for teachers.

In the four years since the opening of the Institute, HudsonAlpha has invested more than \$2 million into Alabama education programs, impacting more than 200,000 students, teachers, and members of the public. We are serious about improving genetics edu-

cation and are continually on the lookout for ways to translate the scientific discoveries into educational experiences.

That is why HudsonAlpha collaborates with a wide array of partners. Some assist in programmatic development and implementation, while others provide needed funding. Our collaborators include national agencies like the Department of Labor and the National Institutes of Health, two- and four-year universities and K-12 education systems across Alabama. In fact, HudsonAlpha has a relationship with every group providing testimony to you at today's meeting.

If I can go off script for a second, I think the key message you will hear from all of those at the table is the importance of partnerships in creating networks, each supporting each other. None of us is able to function on our own in order to be successful for STEM education.

Whether it is in partnership with statewide programs like the Alabama Math, Science, and Technology Initiative, or the newly formed Illinois Pathway Initiative, industry and non-profit organizations across the country have a critical role in providing content support and links to student career opportunities.

Based on HudsonAlpha's experience, a few key points have emerged that are critical to non-profit success in this area.

First, we have become familiar with the education scaffold across primary, secondary, and higher education. We look for those areas that are a natural fit with HudsonAlpha's content expertise and identify when the topics are generally taught. This is at the middle school, the high school, or not until graduate-level training. Knowing when a content area is taught allows us to approach the appropriate educational partner.

Second, we identify ways we can support existing educational requirements. This may range from providing guest speakers or background material for a classroom discussion to creating materials and teacher training for a statewide initiative.

Third, we have to realize that the narrow, highly technical details that are HudsonAlpha's area of expertise may not match classroom concepts and instead need to focus on a more foundational topic within the field. I cannot stress how important this point is to success in education in the STEM field. Industry and non-profits have great knowledge to share, but often attempt to force fit an overly detailed lecture or activity into a classroom. This can inadvertently cause more harm than good.

Finally, we have learned that any successful collaboration is going to require a serious investment. This may or may not be financial in nature, but will almost certainly require an investment of time. This relationship must go beyond simply writing a check or dropping off surplus equipment.

A motivated and skilled workforce pipeline requires a solid education that continually grows over time. As a society, we must support approaches that best facilitate the pursuit of this knowledge. Our citizens need to embrace learning, and our society needs to reward those who give their time, effort, and passion to that pursuit.

Thank you, Mr. Chairman and Representative Lipinski, for the opportunity to appear before you today.

[The prepared statement of Dr. Lamb follows:]

STEM Education in Action: Local Schools, Non-Profits, and Businesses Doing Their Part to Secure America's Future

Field Hearing, April 30, 2012

Subcommittee on Research and Science Education

Committee on Science, Space and Technology

*Testimony provided by Neil E. Lamb, Ph.D.**Director of Educational Outreach – HudsonAlpha Institute for Biotechnology***Questions and Answers:**

1. What makes HudsonAlpha unique and why did you choose to locate in Huntsville? What goals does the institute hope to accomplish by promoting STEM education, and how are these goals useful to the Huntsville area, Alabama, and the nation as a whole?

The HudsonAlpha Institute for Biotechnology is a nonprofit research institute with a strong focus on both the advancement of knowledge in genomics (the branch of science associated with the study of the total genetic information for an organism) and the application of that knowledge. HudsonAlpha has a three-fold mission of conducting genomics research to improve human health and well being, sparking economic development, and providing educational outreach that inspires youth to pursue careers in science. HudsonAlpha's tagline, *The Science of Progress*, represents our collective realization that advancement results from this three-fold approach:

- building a team of well-networked researchers with complementary skills in a non-profit setting;
- attracting established businesses and budding entrepreneurs to translate discoveries from the lab into services and products; and
- establishing strategic avenues of educational outreach that fill the workforce pipeline and address deficiencies in public knowledge.

Led by Dr. Richard Myers, formerly the chairman for the department of genetics at Stanford University, HudsonAlpha's research faculty focus on using genetics and genomics to understand the normal function of organisms, to inform and improve patient care and to assist in development of new and sustainable energy sources. This research takes place under the same roof with more than 20 biotechnology-related companies, demonstrating our belief that proximity between research and industry builds collaboration and moves discovery into application at a faster, more efficient pace.

Jim Hudson and Lonnie McMillian, the founders of HudsonAlpha, have strong roots to Huntsville, having each created and matured successful businesses in the area. Huntsville offers both the culture of innovation and the emphasis on strong STEM education that is necessary to create the "Ah-ha!" moments that move research forward and turn ideas into products.

HudsonAlpha's educational programs for teachers and students are organized around two guiding principles: preparing the future biotechnology workforce and cultivating an

awareness of the influence of genetics and biotechnology on the lives of all citizens. Our support of STEM education is beneficial to both the institute and the country. Advanced scientific and technological achievements require a workforce that has committed to continuous learning and the understanding of complex concepts and relationships. This requires that learners become engaged in the pursuit of knowledge early in their education and build on that knowledge throughout their lifetime. HudsonAlpha seeks to contribute to this continuum of learning.

2. Please describe HudsonAlpha's STEM education activities. How do you measure the results of these initiatives? Does the institute partner with any other organizations to further STEM education? If so, what organizations?

By collaborating with educators, policy makers, civic groups and corporate funding partners, HudsonAlpha's educational outreach team connects academic learning with real-world application. We develop and implement hands-on, inquiry-based activities for students, host in-class and online student discussions, provide summer camps and intern opportunities, and offer professional development sessions for educators. During the 2010-2011 academic year, these activities reached over 50,000 Alabama students, teachers and members of the public. Based upon these accomplishments, HudsonAlpha has become a leader in genetics education at the national level. We are routinely invited to present at national education meetings and public policy discussions related to genetic education.

In general, our programs can be divided into several clusters, based loosely around the target audience or the type of activity developed.

1. Hands-On Classroom Activities – In partnership with the Alabama State Department of Education, HudsonAlpha developed a genetics and biotechnology module for middle school students. The activities associated with the module have been implemented statewide through the Alabama Math, Science and Technology Initiative (AMSTI) and will be used by more than 8,000 students during the current academic year. We have also designed and implemented five genetic-based laboratory activities for high school classrooms. Each activity meets state-mandated course of study requirements for multiple classes; for example, an inquiry activity on DNA extraction can be used for an introductory biology class and a biotechnology career tech course. These have been incorporated into Alabama Science in Motion (ASIM), the high school component of AMSTI. During the 2010-2011 academic year, more than 10,000 Alabama high school students from over 270 classrooms used these kits.

2. Teacher Training Opportunities – HudsonAlpha has crafted a summer educator workshop, Genetic Technologies for Alabama Classrooms (GTAC), for Alabama high school biology instructors. This two-week immersive experience provides training in both content and pedagogy (*i.e.* the practice of teaching), using hands-on modules to incorporate genetic concepts into the biology classroom. The goal for GTAC is to help an educator become comfortable

discussing genetic concepts and terminology, as well as the ethical, social and legal issues associated with these concepts. The educator can then reinforce those concepts through hands-on laboratory modules. All activities link to state course of study standards for biology. In this way, teachers can build the foundation students need to understand genetics as well as the application of the content. By incorporating hands-on activities, students gain the skills required to succeed in the global marketplace for careers in research, healthcare, agriculture, defense and information technology.

HudsonAlpha is in the process of increasing our teacher outreach efforts through shorter-term workshops that will be held across the state. These expanded efforts will impact over 1,000 life science and career/technical education teachers during the coming year. The educational outreach program also produces the annual *Biotechnology Guidebook*, an easy-to-read overview of new findings in the fields of genetics and biotechnology and the connections to high school life science courses. This year's guidebook was mailed to every high school in Alabama and is freely available from the HudsonAlpha website. The guidebook and a presentation of the new genetic discoveries it contains has become a regular feature at the National Association of Biology Teachers annual meeting.

3. Student Experiences – Beginning in 2012, HudsonAlpha has developed a series of half-day and full-day field trip opportunities for area middle and high school students. These have proven popular and we will expand these offerings for the 2012-13 academic year, with a particular emphasis on including groups historically underrepresented in the sciences.

HudsonAlpha offers a summer internship program called BioTrain for high school through graduate students, providing experiences that range from in-depth laboratory research to biotechnology marketing and business strategy. Internships are offered through HudsonAlpha's nonprofit research labs, the for-profit associate companies and the educational outreach program. BioTrain internships are a valuable stepping stone that links classwork with real-world experience. Interns gain skills and knowledge that prepares them for the workforce as well as related higher education coursework. Simultaneously, interns learn to work in professional settings, dealing with workplace values like punctuality, respect and time management. In return, BioTrain interns become part of the eligible future workforce and build a relationship with a biotechnology company or researcher.

One of HudsonAlpha's earliest educational outreach programs created a series of laboratory activities to support AP biology classes. A group of scientists and graduate students travel to a high school and help the students work through various laboratory activities required by the AP program. This has expanded to serve nearly every high school in Madison County with a 50+ volunteer base. This past October, HudsonAlpha staff published a description of the program and its benefits in *The American Biology Teacher*. Beginning Fall 2012, the revised AP biology course will be introduced. We are working with area teachers to

provide content support and mentor students through the revised laboratory exercises.

4. Digital Activities – In October 2011, HudsonAlpha released an updated version of our popular iCell™ app for Apple® and Android® phones and tablets. iCell™ allows students to explore the inner structure of plant, animal and bacterial cells, learning about the organelles using different levels of complexity. The app was quickly identified by Apple® as a “New and Noteworthy App” and for several days, was in the top five free educational apps. To date, more than 70,000 individuals have downloaded the iCell™ app.

GenomeCache™ is another free app developed by HudsonAlpha. Along with its accompanying website, this app helps teachers assemble a “Genome Walk,” a physical representation of the human genome that includes information on over 150 genes of interest. The GenomeCache™ app uses the Genome Walk as the setting for a genomic scavenger hunt, similar to the way geocaching uses GPS coordinates in the search for tiny treasures. This year, a network of Alabama classrooms hosted Genome Walks as part of HudsonAlpha’s statewide celebration of DNA Day, reaching over 2500 students.

In 2011, HudsonAlpha was awarded a \$1.1M, NIH-sponsored Science Education Partnership Award. With these funds, we are designing and implementing “Touching Triton™”, an online activity to explore risk factors associated with complex disease. Set in the context of a 20 year mission to a distant moon, the activity will help students assess disease risks for crew members based on family history, medical records and genomic data. Touching Triton™ will be introduced across Alabama in 2014, with nationwide expansion to follow.

5. Public Activities – Since 2008, HudsonAlpha has offered a public education short course called Biotech101. This five-week series covers the basic concepts of genetics, genomics and biotechnology, and is taught by HudsonAlpha faculty. To date, more than 900 individuals have participated in the Biotech101 course. Once individuals have completed “101”, they are eligible to take “Biotech201”, which highlights a different topic area every winter. This year, the focus was on type 1 and type 2 diabetes. More than 280 individuals attended this year’s series. All sessions are free of charge to the public, thanks to sponsorship by local businesses.

As a first line of evaluation for our initiatives, we seek feedback from educators regarding the quality and utility of our educational kits and modules. At both the middle and high school levels, this feedback has been overwhelmingly positive. Teachers express appreciation for the ability to expose their students to these types of hands-on activities, especially in terms of how they link to both current applications and careers.

As often as possible, we use more formal assessment methods to measure the impact of our initiatives. For our school activities, we ask if the activity helps students comprehend the objectives it is designed to address. This information may be informally assessed

through student or teacher comments. In an ideal setting, we could determine if the programs improve student scores on high stakes assessment exams, such as the Alabama Science Assessment. Student test scores are impacted by a number of variables, making it difficult to ascribe changes in scores to any one event. Even so, after using the 7th grade module developed by HudsonAlpha, our pilot schools noted a significant increase in the percentage of students that correctly answered questions relating to the state genetics and DNA content standards. For example, one school's content standard about "genetics" moved from 30 percent correct to 71 percent and the "DNA" content standard increased from 48 percent to 67 percent. We are working with the Alabama State Department of Education to compare assessment results on a broader scale as the 7th grade module is introduced statewide.

In terms of assessing the impact of teacher professional development initiatives, we look for changes in teacher content knowledge before and after the two-week GTAC academy. Based on pre- and post- academy questionnaires, educators increased content knowledge in key areas related to genetics:

- in aggregate, the knowledge of basic genetic concepts increased from 66.7 percent to 79.5 percent
- genetic technologies understanding increased from 53.5 percent to 66.7 percent
- Mendelian inheritance increased from 78.9 percent to 87.7 percent
- content knowledge about complex genetics increased from 78.9 percent to 86.8 percent

An additional, unforeseen but welcome finding showed that attendees increased awareness of themselves as "professional educators" rather than "simply a school teacher." This enhanced role as a teacher leader carried into the school year in tangible ways: two GTAC alumni successfully secured external funding for classroom activities, two have given district-level professional development talks and three presented their work at the Alabama Science Teacher's workshop. In addition, the past two Alabama Outstanding Biology Teachers of the Year are GTAC graduates.

HudsonAlpha collaborates with a wide array of partners, based upon the target audience and content area. Some partners assist in programmatic development and implementation while others provide the necessary funding. Over the past four years, our collaborators have included:

The U.S. Department of Labor
The National Aeronautics and Space Administration
The National Institutes of Health
The U.S. Space and Rocket Center
The Boeing Charitable Trust
Lockheed Martin
The Alabama Math Science and Technology Initiative
The University of Alabama Huntsville
Vanderbilt University
Alabama A&M University

Athens State University
 Calhoun Community College
 Wallace State Community College
 Sneed State Community College
 The SciQuest Hands On Science Center
 Alabama Career and Technical Education
 Madison City Schools
 Huntsville City Schools
 Madison County Schools
 Decatur City Schools
 The Schools Foundation
 A+ College Ready
 The Ben May Charitable Trust
 Jane K. Lowe Foundation
 WesFam Restaurants, Inc/Burger King
 The Alabama Math Science Engineering and Technology Consortium
 The Lawrence County Agricultural Career Initiative
 Servis First Bank
 Maynard, Cooper and Gale, PC
 The Daniel Foundation of Alabama

HudsonAlpha is also an active part of BioAlabama, a statewide organization representing the biology-related industries, research scientists, clinicians and business officials that support life sciences. BioAlabama plays an important role promoting innovation and talent development by creating a favorable scientific, business, legislative and educational environment across the state. This type of network, where stakeholders work together toward common goals, is a key component for success in recruiting and retaining workforce talent to maintain a place at the front of scientific advancement and the application of those discoveries.

3. What incentives inspired HudsonAlpha to undertake STEM education? How can other nonprofit organizations mirror similar programs, and how would it benefit them and the communities they serve to do so?

The opportunity to positively impact STEM education was a driving reason why the founders of HudsonAlpha included education as a critical piece of the mission statement. The value of a trained workforce and the benefit of a research-friendly community were other considerations in stepping into STEM education space. There is consensus that skills derived from a strong STEM curriculum are of vital importance to national prosperity, security and the health of our citizens. The United States has long been a recognized world leader in scientific achievement. Equally important, the U.S. is the recognized leader in using that achievement to innovate and build wealth. Disturbing trends reflect a decline in the number of students who train to become scientists and engineers. With fierce competition from nations seeking to overtake the U.S. position in achievement and innovation, sustained support of STEM education at a national level is mandatory. At the same time, states, non-profits and industry must also invest to nurture

budding science and engineering professionals. A motivated and growing workforce pipeline is required to keep pace with emerging human needs and competing nations.

Said another way, on April 23 of this year, Dr. Subra Suresh, director of the National Science Foundation remarked to an audience of community leaders from North Alabama that innovation is a contact sport. He is correct; sitting on the sidelines does not effect change. HudsonAlpha aims to create and sustain an ecosystem of innovation that not only strengthens Alabama's industrial base, but also supports and protects our nation's preeminence in discovery and application.

A recent study from Georgetown University's Center on Education and the Workforce noted that with the exception of some academia Ph.D.-level researchers, the demand for STEM workers is increasing for individuals with all levels of education. The drive for innovation is critical to the success of a wide swath of America's economy and strong STEM concepts lie at the heart of many of these innovations. Other nonprofit organizations can engage in the STEM educational arena by identifying the logical spaces to provide content support for educators and classrooms. This engagement may simply provide support for one topic in a single classroom or influence an entire state's educational initiatives. In Alabama, the Alabama Math, Science and Technology Initiative (under the state department of education) spearheads efforts to reach K-12 students. Other states have similar hands-on educational programs. The existence of distance learning networks similar to Alabama's ACCESS program offers an additional avenue for groups to create online content that inspires students and promotes STEM achievement. Providing student internships and cooperative education experiences present invaluable opportunities for students to see a future in STEM fields.

In total, these offerings help preserve our nation's standing, continue economic gains and afford a higher quality of life for all citizens.

4. How do we avoid a disconnect between the jobs we want to keep in the U.S. and our workforce's ability to perform those jobs? How do partnerships with colleges and universities help alleviate that disconnect?

Historically, the United States has led and benefited from both agricultural and manufacturing-based economies. In the same way, our leadership in the knowledge economies of Information Technologies and the life sciences has produced clear gains. Continued economic growth requires an increasing number of highly skilled workers. A 2009 survey of the Business Roundtable found that 65 percent of surveyed employers now require an associates degree or higher for most positions.

However, in spite of the uptick in training and certification programs, and even in the face of relatively high unemployment, many employers still face job shortages for technically demanding positions. The required set of worker skills has changed as industries innovate and evolve. The entire education system (K-12 and higher education) must prepare the future workforce to understand and competently perform these skills.

Importantly, the relationship between those who develop businesses and those who prepare our workforce requires ongoing and extensive dialog. Without industry involvement, it is difficult for the educational institutions to identify skills and competences and nimbly respond with well-matched training. At HudsonAlpha, we encourage this dialog through both proximity (pushing educators, researchers and industry constituents physically into shared spaces) and structured encounters (seminars, information sharing between teachers, scientists and business leaders, opportunities to collaborate, etc.). Similar efforts that support dialog between business and educators on a larger scale help promote integration and collaboration. Without this dialog, business and education may not only fail to integrate, but may even work at cross-purposes.

HudsonAlpha has partnered with area schools of higher education to provide guest lecturers from among our faculty, introducing undergraduate students to cutting-edge technology and research discoveries. At the graduate level, we have partnered with the University of Alabama Birmingham to bring doctoral students in human genetics into HudsonAlpha's labs for their dissertation research. This collaboration connects the clinical expertise of UAB with the genomic skill set of HudsonAlpha, exposing students to a richer set of scientific experience. A similar graduate student relationship has been established with the University of Alabama Huntsville.

Much of the recent STEM career emphasis has focused on a relatively small population of highly trained scientists and engineers; more than one-third of all projected STEM-related jobs will require a workforce trained at the high school and sub-baccalaureate level. This is a previously neglected portion of our nation's STEM career pipeline. Strengthening student acquisition of STEM skills through the career and technical education programs in high school, trade school and community colleges is an important component that should not be ignored when addressing the disconnect between workforce training and required job skills. One of HudsonAlpha's earliest collaborations was with Calhoun Community College to support the creation of an associate degree program in biotechnology. Now in its fourth year, the program serves as an important entry point for students considering careers in the life science arena. In similar ways, HudsonAlpha works closely with the Career and Technical Education division of the AL Department of Education, providing activities and content support for high school career/tech teachers in health profession, agriscience and forensics fields.

5. How can we attract, educate and retain the critical mass of talent necessary to keep the state of Alabama, and the nation as a whole, at the forefront of research, development and groundbreaking advances in science and technology?

Preparing our citizenry to lead in the development and use of advanced science and technologies will continue to be one of our nation's most essential responsibilities. STEM education must be elevated as a national priority in terms of reform, spending and innovation strategies. In particular, student performance in science should rank alongside reading and mathematics as a key component of educational accountability systems. Supporting this emphasis on foundational content, students should be exposed to a broad

range of career exploration opportunities (job shadows, internships, problem-based experiences, service learning projects) which allow students to test drive a career and learn from the individuals who possess the experience the students are looking to acquire.

Our nation needs to ensure all of these opportunities include student groups traditionally underrepresented in science. The pipeline must be expanded to reach a larger population of STEM-interested students. Lastly, it is no longer enough to simply present content and provide skill development opportunities: We need to deliver them in a format that is compelling and engaging enough to win the learner's attention. This must be done while competing with all the entertainment and social attractions of our society. Scientific and technological competence (not to mention innovation) requires a solid education that continually grows over time. As a society, we must support approaches that best facilitate the pursuit of this knowledge. Our citizens need to embrace learning and our society needs to reward those who give their time, effort and passion to that pursuit.

Chairman BROOKS. Thank you, Dr. Lamb.
The Chair next recognizes Mr. Partynski.

**STATEMENT OF MR. ANDREW PARTYNSKI,
CHIEF TECHNOLOGY OFFICER,
SCIENCE APPLICATIONS INTERNATIONAL CORPORATION**

Mr. PARTYNSKI. Good morning, Chairman Brooks and Member Lipinski. Let me first say I am honored to have the opportunity to appear before you today, and I would also like to thank Bob Jones High School for your wonderful hospitality.

SAIC is a Fortune 500 scientific, engineering, and technology applications company that uses its deep domain knowledge to solve problems of vital importance to the Nation and the world in national security, energy and environment, health and cybersecurity. SAIC employs approximately 41,000 personnel worldwide, with approximately 10,000 employees with advanced degrees and over 20,000 employees with security clearances.

I am the regional coordinator of STEM initiatives in Huntsville, and I am also part of a corporate committee that focuses on STEM. A major focus of SAIC's STEM program is to help provide our employees meaningful opportunities to volunteer in their communities. Our employees' actions will inspire students directly through their interactions with SAIC, will ignite a peer-to-peer spread of interest in volunteering within the SAIC employee population, and indirectly can stimulate viral student-to-student interest in STEM.

The current environment in Huntsville when recruiting candidates requires that we compete for the same existing finite pool of talent. Due to the current growth in Huntsville and attendant job opportunities, we have had to recruit and relocate qualified people from across the country because of the shortages of available and technically skilled engineers. The difficulty to recruit these candidates in a timely manner has been specifically acknowledged by our customers on Redstone Arsenal. Our experience shows that talent of all ages self-selects into working on big technical problems. The bigger the problem, the more inspired and attracted talented people become by that challenge.

To prepare for this current and future need, SAIC has initiated several thrusts. First, we have established a relationship with UAH by working on creating and tailoring some degree programs, bidding on cooperative research projects, providing scholarships to identify key talent, and working to provide internships at SAIC and ultimately hiring the graduates. Our stated goal with UAH is to help it be recognized as a national go-to school for the disciplines needed by our customers and the Huntsville community.

We also understand that to inspire our younger generation to get into STEM fields, we have to attract them early. To do this, SAIC has strategically selected to support FIRST robotics, Project Lead the Way, and also Alabama A+ College Ready.

FIRST robotics offers elementary, middle, and high school students a series of popular extracurricular activities structured around robotics competitions, and includes contests at the local, regional, and national levels. Locally we support a dozen teams from

elementary through high school, and we are only one of a dozen SAIC entities that have similar support efforts across the country.

SAIC also selected Project Lead the Way as one of its strategic initiatives because the program produces demonstrated results, it offers a ready-made infrastructure already present in schools and districts across the country, and it offers many ways for SAIC employees to engage in their communities.

As part of SAIC's Project Lead the Way regional strategy, we funded the startup of Project Lead the Way engineering curriculum at New Century Technology High School.

We volunteered to co-chair the Tennessee Valley Project Lead the Way strategy under ASMDA and NDIA. The goal of this joint committee is to gain synergy in supporting all three school district superintendents that are piloting Project Lead the Way in a high school.

SAIC volunteers are working to create an environment where best practices for deploying the curriculum can be shared across all three school systems. They are also creating a one-stop-shop capability to support the needs of Project Lead the Way teachers, including finding sponsors to fund courses, recruit and place mentors for the classroom, and set up industry and government internships for students to explore STEM career fields. The strategy focuses on providing these Project Lead the Way support services for high schools first, but will expand to support K–8 schools in the coming years.

SAIC coordinated and deployed a 10-week cyber curriculum called CyberNEXS to eight schools in the Huntsville City school district. SAIC organized mentors both within SAIC and external to work with the eight schools in Huntsville, and two of the schools that went through this cyber training have qualified through two levels of National Cyber Patriot competitions run by the Air Force Association.

SAIC also worked with Project Lead the Way to develop technologies for the upcoming cyber curriculum. Huntsville's Grissom High School was chosen as one of two schools nationally to pilot this new cyber security curriculum at the high school level.

SAIC also contributes to Alabama's A+ College Ready as part of a \$1 million commitment by the community in Huntsville and Madison County to implement AP programs in 10 local high schools, making this an exemplary public-private partnership. After just one year in the A+ College Ready program, 43 Alabama high schools showed an average 108 percent increase in AP qualifying scores, 13 times the national average of 8.1 percent. Alabama's percentage increase in qualifying scores on AP exams from 2008 to 2011 ranks Alabama number one among all 50 States in qualifying scores on exams and minority qualifying scores on exams.

In closing, one of the greatest challenges for any company in the technical fields today is finding and attracting top talent in all technical areas. Our greatest method of attraction is inspiration in the mission and to the contribution to our Nation and society.

Our government was able to achieve this rallying vision under President Kennedy when he announced the national challenge to go to the moon. This vision created the largest increase in enrollment in STEM fields in U.S. history. Today we need an equally vi-

sionary challenge that inspires the imagination and passion of our young people. This challenge needs to go beyond typical rhetoric and stimulus and strike at the hearts and minds of the generation that uses technology transparently and can multiplex many activities at once. Once inspired, this generation, these young people, will rise to the challenge with passion and innovation that will make us proud to be Americans.

Thank you.

[The prepared statement of Mr. Partynski follows:]

**Testimony of Mr. Andrew J. Partynski,
Congressional Field Hearing on STEM Education in Action
Committee of Science Space & Technology
Subcommittee on Research & Science Education
April 30, 2012**

Good morning Representative Brooks and committee members. My name is Andrew Partynski and I am the Chief Technology Officer for SAIC's Systems and Technology Solutions business, which is headquartered in Huntsville, Alabama. Let me first say I am honored to have the opportunity to appear before you today. I would also like to thank Bob Jones High School for your wonderful hospitality.

SAIC is a FORTUNE 500® scientific, engineering and technology applications company that uses its deep domain knowledge to solve problems of vital importance to the nation and the world in national security, energy & environment, health and cyber security. SAIC employs approximately 41,000 personnel worldwide with approximately 10,000 employees with advanced degrees and over 20,000 employees with security clearances. SAIC is proud of 40 years of continuous growth with approximately \$11 billion in annual revenues for fiscal year 2011.

SAIC is justifiably proud of the caliber of our personnel and of our ability to attract and retain skilled senior engineers and scientists. A large percentage of our SAIC's 41,000 employees work in technical fields, ranging from information technology, energy, cyber security, and life sciences. Our technical staff professional education consists of 59% with Bachelor's degrees, 36% with Masters Degrees, and 5% with Doctoral degrees.

Our accomplished employees contribute substantially to the success of our customers; they also serve as leaders in their fields, both within SAIC and in the national and global technical community. SAIC experts serve as board chairs, members, advisors, and instructors for dozens of government boards, science and technical organizations, and universities. We have dozens of technical communities of practice (CoP) contributing to our overall capabilities across the enterprise with innovative thinking for new perspectives and solutions. This deep and diverse foundation of talent underpins SAIC's reputation as a leading science and technology company.

Huntsville Community

The 2010 American Community Survey (performed by the Census) confirms that the Huntsville Metro Area has the highest per capita concentration of engineers in the country with 11,392 engineers making up 6.0% of the total employed residents. San Jose/Sunnyvale/Santa Clara is second at 5.1%. We also rank second in the nation, just behind San Jose, in high-tech workers overall. These characteristics of our workforce are critical to our future economic growth – we must maintain and build on our assets as we diversify into emerging markets like biotech.

SAIC's K-12 STEM Involvement

I am the regional coordinator of Science, Technology, Engineering and Mathematics (STEM) initiatives in Huntsville and am part of a corporate committee that focuses on STEM. It's imperative that corporations like SAIC remain steadfast in their commitment to being responsible citizens in the regions where we operate. For me, a key component of corporate responsibility is in helping build the future workforce. More importantly, it is essential for our national security because our economy has been and will continue to be based upon a foundation of technology and innovation. This requires a STEM-educated workforce, which in turn requires a pipeline of students inspired, engaged and educated in STEM disciplines.

A major focus of SAIC's STEM program is to help provide our employees meaningful opportunities to volunteer in their communities. Our employees' actions will inspire students directly through their interactions with SAIC, will ignite a peer-to-peer spread of interest in volunteering within the SAIC employee population, and indirectly stimulate viral student-to-student interest in STEM. Many SAIC employees in Huntsville volunteer their time and talents helping to inspire, engage and educate K-12 students in STEM related activities with a variety of programs.

We have taken a number of steps to promote STEM including providing financial resources, supporting strategic initiatives and providing mission focus. But the most important component of our program is our workforce. We consistently emphasize that together we can make a major difference if we deploy SAIC's "marching army" across the country. The components of our

STEM program are designed to help make this possible. A few of the programs are described below.

FIRST

SAIC has selected *FIRST* (For Inspiration and Recognition of Science and Technology) as one of our strategic initiative because *FIRST* offers elementary, middle and high-school students a series of popular extracurricular activities structured around robotics competitions, and includes contests at the local, regional and national levels. The organization is well developed and scalable as new teams are created, giving SAIC employees a variety of ways to get involved. The mission of *FIRST* is to inspire young people to be science and technology leaders, by engaging them in exciting mentor-based programs that build science, engineering and technology skills, that inspire innovation, and that foster well-rounded life capabilities including self-confidence, communication, and leadership. Simply put, it provide the type of inspiration in students that is the catalyst needed for getting students interested in technical fields.

Locally, SAIC supports a dozen *FIRST* Robotics and *FIRST* Lego teams – each with SAIC employees actively involved in mentoring and coaching the teams.

Project Lead the Way (PLTW)

Additionally, SAIC has selected Project Lead the Way (PLTW) as another of its strategic initiatives because the program produces demonstrated results, offers a ready-made infrastructure in schools and districts across the country and offers many ways for SAIC employees to engage in their communities.

In fact, a key to PLTW's success is its ability to convey the real-world relevance of classroom lessons to students, and this ability relies heavily on corporate supporters such as SAIC. PLTW's mission is to ensure that America succeeds in the increasingly high-tech and high-skills global economy by partnering with middle schools and high schools to prepare students to be the most innovative and productive in the world. It provides middle and high-school students with activities-based, project-based and problem-based learning through engineering and biology

curricula; it trains teachers to use these curricula effectively; and assists schools with the capital costs necessary for equipping their facilities to teach the curricula.

Most recently in Huntsville, SAIC funded and assisted in the start-up of the PLTW engineering curriculum at New Century Technology High School. We're now involved with and are working with PLTW on cyber technologies for their upcoming cyber curriculum as well. Given the importance of this area of focus and critical nature for educating future leaders in cyber, we're particularly excited about this opportunity.

One of SAIC's senior managers currently co-chairs the Tennessee Valley PLTW strategy under Air Space & Missile Defense Association (ASMDA) & National Defense Industrial Association (NDIA) where the PLTW curriculum startup process will be streamlined for all three school districts in Madison County. The goal of the joint committee is to gain synergy in supporting all three school district superintendents that are piloting PLTW in a high school. They are developing best practices for deploying the curriculum allowing all the schools to leverage startup streamlined process (typically each school has to figure out how to start the program on their own). This process allows any school to use the PLTW Purchasing Manual to make a PLTW purchase request for each class, the STEM committee then evaluates and approves requests. Schools are then able to order PLTW equipment and receive reimbursement from the STEM committee.

While this effort was initiated for high schools and middle schools, plans are underway for it to be expanded to K-8 schools in the coming years.

CyberNEXS

Again, realizing the importance of cyber and the increased threat our country will face in this area; SAIC provided our specialized 10-week course in cyber security to the Huntsville City School system called CyberNEXS, at no cost to the system.

We deployed cyber mentors and course materials to teachers and students and helped with the program at the eight participating Huntsville schools. Two of the schools that went through this

Cyber training have qualified through two levels of National CyberPatriot competition that SAIC's supports with our CyberNEXS system.

CyberPatriot, the US Air Force Association's premiere national high school cyber defense competition, was created to inspire high school students toward careers in cyber security or other science, technology, engineering, and mathematics disciplines critical to our nation's future.

By investing in critical technologies and curriculum, we're working to develop and inspire future leaders in this extremely critical area of emphasis.

Alabama A+ College Ready

Another strategic involvement area for SAIC is A+ College Ready. The mission of this state-wide program is to increase dramatically the number of students in Alabama taking math, science, and English AP courses, earning qualifying scores on advanced placement (AP) exams and ultimately attending and succeeding in college. The SAIC contribution of \$100,000 is part of a \$1 million commitment made by the corporate community in Huntsville and Madison County to implement the AP program in 10 local high schools – making this an exemplary public-private partnership.

Results confirm that the program is making an impact. After just one year in the A+ College Ready program, 43 Alabama high schools showed an average 108% increase in AP qualifying scores – 13 times the national average of 8.1%.

Alabama's percent increase in qualifying scores on AP exams from 2008 – 2011 ranks Alabama #1 among all 50 states in qualifying scores on AP MSE exams and minority qualifying scores on AP MSE exams.

Strategic University Alliance – UAHuntsville

Our focus on STEM certainly doesn't end with K-12. SAIC has created a set of Strategic University Alliances to focus on-campus activities in support of the company's strategic goals, particularly by strengthening the science and technology core of SAIC.

The Strategic University Alliance schools were chosen by SAIC's University Relations Committee after a rigorous, collaborative process that included our business leadership, human resources/recruiting, the Office of Technology, and others. UAHuntsville is one of the original seven schools that were selected because of their strengths in areas important to our strategic plans for growth and because they're a good source for recruiting interns and recent graduates. I serve as the official SAIC representative for UAHuntsville. We have allocated discretionary funding to support the activities with the university and are supported by an Advisory Council drawn from stakeholders across the company.

Together, this team sets the goals and objectives for each campus and determines how to best invest the Corporate Discretionary Resource (CDR) funding. We fund and collaborate with the university on technology developments, curricula, and even work to jointly bid on research projects. Our efforts in developing curricula with the university will help support the needs of the corporation, our customers and the entire Huntsville community. As an example we have supported the development of a Masters program in Optical Systems Engineering, a PhD program in modeling and simulation and we are currently working on a graduate level program for Operations Research and Systems Analysis (ORSA).

SAIC also provides an annual scholarship based on case studies in complex systems: this year's topic was designing a hospital for the 21 century. This scholarship for UAHuntsville students identifies some of the best and brightest talent at the university demonstrating critical thinking in complex systems problems.

Our executive leadership team has seen the value in these efforts and have commented that SAIC will have continued growth and investment in Huntsville due to the fact that Huntsville has a unique opportunity for growth with a DoD-NASA business opportunities. They recognize that the people of this area are well-educated and technically inclined. ... "They want to do what's best for the country."

Comments/Conclusion

As the regional coordinator of STEM initiatives in Huntsville, I serve on a SAIC corporate committee that focuses on STEM. As a premier science and engineering company that prides

itself on its technical workforce in an ever increasing technical world, SAIC strives to recruit and retain the nation's best and brightest to support our customers. The ability to find locally skilled talent is a key component to effectively servicing of our Government customer. The current environment in Huntsville when recruiting for Engineering/ Software Engineering candidates requires that we compete for the same existing finite pool of talent.

Due to the current growth in Huntsville and attendant job opportunities, we have had to recruit and relocate qualified people for across the country because of the shortage of available and technically skilled engineers, especially those that possess knowledge and experience with the newer design and development tools and programming languages.

The difficulty to recruit these candidates in a timely manner has been specifically acknowledged by our customers on Redstone Arsenal. If the trend of the past five years can act as an indicator for the near future, my fear is that our ability to locate, recruit, and retain the necessary talent locally will become increasingly more difficult.

Our experience shows that talent of all ages self-selects into working on big technical problems. The bigger the problem, the more inspired and attracted talented people become by that challenge. Once attracted to the technical challenge, these students naturally began "see" how they might contribute and pursue educational opportunities to address these challenges. SAIC attracts very talented people the same way, we work on the nation's toughest challenges and bright people from all backgrounds find ways to contribute. Because we draw on this talent pool SAIC understands we have a responsibility to sustain this pipeline of bright young talented people.

To prepare for this current and future need SAIC has initiated several thrusts. First we have established a relationship with UAHuntsville by working on creating and tailoring the degree programs, bidding on cooperative research projects, providing scholarships to identify key talent and working to provide internships at SAIC and ultimately hiring the graduates. Our stated goal with UAHuntsville is to help it be recognized as a national go to school for the disciplines needed by our customers and the Huntsville community. We also understand that to inspire our younger generation to get into STEM fields we have to attract them early. To do this SAIC has

strategically selected to support FIRST robotics, Project Lead the Way and also Alabama A+ College ready.

FIRST offers elementary, middle and high-school students a series of popular extracurricular activities structured around robotics competitions, and includes contests at the local, regional and national levels. Locally we support a dozen teams from elementary to high school – and we are only one of a dozen SAIC entities that have similar support efforts across the country..

SAIC also selected Project Lead the Way (PLTW) as one of its strategic initiatives because the program produces demonstrated results, it offers a ready-made infrastructure already present in schools and districts across the country, and it offers many ways for SAIC employees to engage in their communities.

PLTW Regional Strategy

We have funded the startup of PLTW engineering curriculum at New Century Technology High School.

We volunteered to co-chair the Tennessee Valley PLTW Strategy under ASMDA & NDIA. The goal of the joint committee is to gain synergy in supporting all three school district superintendents that are piloting PLTW in a high school. SAIC volunteers are working to create an environment where best practices for deploying the curriculum can be shared across the three school systems. They are also creating a one stop shop capability to support the needs of the PLTW teachers including finding sponsors to fund courses, recruit and place mentors for the classroom and setup industry and government internships for students to explore STEM career fields. The strategy focuses on providing these PLTW support services for high schools first but will expand to support K-8 schools in the coming years. Many challenges are being worked by this committee

Cyber.NEXS

SAIC coordinated and deployed a 10-week CyberNEXS curriculum to eight schools in the Huntsville City Schools district and organized Cyber mentors from within SAIC (5) and external

to SAIC (3) to work with the selected Huntsville City Schools. Two of the schools that went through this cyber training have qualified through two levels of National Cyber Patriot competition.

Cyber Curriculum

SAIC worked with PLTW to develop technologies for the upcoming cyber curriculum. Huntsville's Grissom High School was chosen as one of two schools nationally to pilot this new cyber security curriculum for high schools. Volunteer mentors from SAIC have supported both the teacher and the students in this effort to inspire and educate these cyber learners. SAIC also enriched their cyber learning environment by providing cyber simulations and other hands on cyber experiences in the Huntsville City Schools.

Alabama A+ College Ready

SAIC also contributed \$100,000 to Alabama A+ College Ready as part of a \$1 million commitment made by the corporate community in Huntsville and Madison County to implement the AP program in 10 local high schools – making this an exemplary public-private partnership. After just one year in the A+ College Ready program, 43 Alabama high schools showed an average 108% increase in AP qualifying scores – 13 times the national average of 8.1%. Alabama's percent increase in qualifying scores on AP exams from 2008 – 2011 ranks Alabama #1 among all 50 states in Qualifying scores on AP MSE exams and Minority qualifying scores on AP MSE exams

In Closing

One of the greatest challenges for any company in the technical fields today is finding and attracting top talent in all technical areas. Our greatest method of attraction is inspiration in the missions and to the contributions to our nation and society. Our government was able to achieve this rallying vision under President Kennedy when he announced the national challenge to go to the moon. This vision created the largest increase in enrollment in STEM fields in US history. Today we need an equally visionary challenge that inspires the imagination and passion of our young people. This challenge needs to go beyond typical rhetoric and stimulus and strike at

hearts and minds of the generation that uses technology transparently and can multiplex many activities once. Once inspired, this generation - these young people, I believe will rise to the challenge with passion and innovation that will make us proud to be Americans.

Chairman BROOKS. Thank you, Mr. Partynski.

I want to thank all the witnesses.

The Chair at this point will open the round of questions. Typically our questions on the Hill are limited to five minutes, but the Chair is going to exercise the Chair's prerogative and grant additional leeway with respect to our timing.

The Chair recognizes himself for his questions. The first question I have is for Mr. Partynski, and Dr. Lamb, if you also will respond after Mr. Partynski has done so.

In order to produce a competent STEM workforce for the future, communications between universities and industry are imperative. How does industry communicate its workforce needs to the education community, and how would you grade industry's efforts in communicating to universities their workforce needs, both current and future?

Mr. PARTYNSKI. Well, first of all, we find that in order for us to communicate our needs with universities, we have to form partnerships with universities. We have to work collaboratively, as we have attempted to do with our strategic university alliance. We have actually formed seven university alliances across the Nation. One of them is with UAH. And those alliances allow us not only to focus our investments at universities but also focus our needs.

For example, we work with universities to develop specific curricula so that they can actually fill the requirements that we see today and forecast for the future. So they are critically important.

As far as having the university work with us to produce these candidates, we actually go to the universities and we recruit. We actually provide scholarships to identify students that have what we consider critical thinking, and we actually provide the university with funding to accelerate some of those efforts.

Chairman BROOKS. How would you grade industry's communication skills, inasmuch as universities and community colleges, K-12, they all want to educate kids in such a fashion so that once they are graduated, they will be market ready, they can get a job? How would you grade industry's ability to communicate the high-tech needs to K-12, community colleges and universities?

Mr. PARTYNSKI. I think our communication still requires a lot of work. It is not adequate where we are today. What we are finding is that there is a balance between communication of needs and having a skilled and experienced workforce, especially in Huntsville. One of the areas that we are working with the university on is to provide internships and summer job programs to get the students, their experience base up a little higher, because the customer base in Huntsville requires primarily experienced people that they want to hire as opposed to direct college graduates.

So we still have a lot of work to do to work with universities to actually communicate needs and what type of students we need.

Chairman BROOKS. Dr. Lamb, you are sitting in a little bit of a different chair because of the hybrid nature of HudsonAlpha, on the one hand research and innovation, and on the other hand you partner with industry. So how would you answer those questions?

Dr. LAMB. I would say that we have to do a better job directly communicating with our education network, whether that is K-12 or our two-year or four-year schools. We historically, at least in our

field, have ended up with an enormous number of students who have been told that in order to go into research, into the health sciences, that you have to have an advanced degree. I think that we have a number of students that have come out with a Bachelor's, Master's, or Ph.D., and the field has changed so that it doesn't necessarily support that.

There are an ever-increasing number of positions that are available at the sub-baccalaureate level, and we have to have better communication with our education partners to help them understand that and to recognize the skill set that we are looking for, that it isn't simply individuals that know a great deal of book-based facts but also have hands-on skills.

I think here in Huntsville you have seen more of those direct connections, more of the intern programs that Mr. Partynski talked about, more of those hands-on opportunities building skills as well as knowledge. But I think historically it has been a challenge, and there hasn't been the needed communication between the bio-science industry and our education partners.

Chairman BROOKS. Thank you.

The next question will be for Dr. Wright, Dr. Altenkirch, and Dr. Beck, the flip side of the first question.

There is nothing worse for a young person to have a high school diploma or the two-year degree or the four-year degree, or even advanced degrees, yet not be able to get a job because the education doesn't match the science, technology, engineering and math requirements of industry. In that vein, do you seek industry input when developing curriculums for your students, and do they in turn assist with the academic-to-workforce transitions? If so, how?

And you can—whoever wants to answer first, go for it. Dr. Wright? Or is it going to be Dr. Beck? All I saw was Dr. Altenkirch shift the mic.

[Laughter.]

Chairman BROOKS. Who wishes to go first?

Dr. BECK. At Calhoun Community College, we have good partnerships with business and industry, and we have advisory committees, and the membership on those committees is provided by businesses and industries in this region. So they work with us to ensure that our curriculums do match the needs of the business and industry in this region.

Also, another way that we are served is by co-op and internship positions of businesses and industries throughout the region.

I do think that certainly we are making headway and ensuring our students have the appropriate skills for the jobs in this workforce, and really I believe Dr. Wright said this is a Mecca. It is a Mecca for jobs, from here to many areas of our Nation.

So we are endeavoring every day to reach out to business and industry and to involve business and industry in helping us ensure our curriculums are leading edge.

Chairman BROOKS. Thank you, Dr. Beck. I have seen some of that firsthand over at your Limestone County campus.

Dr. Wright, are you going to take the next stab at it?

Dr. WRIGHT. Sure.

Chairman BROOKS. All right. Thank you.

Dr. WRIGHT. Additionally at the K-12 level, we do try to establish numerous partnerships with business and industry for advisement. So we have an advisory council for career and technical education that is about 12 members, and we meet regularly, and they advise on the new directions for career and technical education, how to really make that—put the edge to the academic so that we have that hands-on experience in the learning.

We have those internships with all of our career tech programs, but we also have a lot of community outreach with the businesses in all of our programs. For example, the Homebuilders Association may partner with our engineering or one of our other classes to help them build a sign for Bob Jones Hospital, things that are really that practical, hands-on application.

I think we do a better job here than maybe is happening across the State. I know that Dr. Bise, the state superintendent, has just hired a new director for career and technical education whose job is outreach also with post-secondary and workforce development. But we are trying to get more involved with workforce development councils, and then we have articulated credit with the post-secondary institutions, and all of that comes directly from the business and industry advisement.

Chairman BROOKS. Thank you, Dr. Wright.

Dr. Altenkirch, you are in a little bit of a different situation, inasmuch as UAH is the brainchild of Wernher von Braun, Marshall Space Flight Center, NASA, national defense needs and industry needs—if my memory serves me correctly, back in the early '60s. So UAH was born in response to industry needs.

But today, what is UAH doing to try to ensure that there is this flow of communication that enhances UAH's ability of producing graduates with the knowledge that our workforce needs?

Dr. ALTENKIRCH. Thank you. I wasn't trying to avoid the question. I just wanted to demonstrate that chivalry is alive and well. [Laughter.]

Chairman BROOKS. Ladies first. I understand.

Dr. ALTENKIRCH. It is a good point. Let me step back and give a little bit of a broad perspective on this, and that is that in college curricula, they are compartmentalized. You have to divide things up in some way. And so we teach mathematics, we teach chemistry, we teach mechanical engineering, et cetera. But at some point, all those have to be integrated, because they are not separated when you go out into an industrial environment.

And so our communication is a lot, if you listened to the testimony carefully, is to interact with industry and the Arsenal and NASA through summer camps, through integrated projects, teams of people from all across the technical disciplines, and high school students that are integrated into those teams, and also students from other universities are integrated into those teams.

So by taking the compartmentalized university instruction and then eventually integrating it together so that people don't believe that these things are all separate. So if you study mathematics, you don't necessarily at the Bachelor's level go out in industry and do mathematics. You do right-scaled projects in which you use mathematics.

So that has to happen at some point along the educational process. We think these interactions with industry and internships, these design projects, et cetera, are a very good way to communicate that importance.

Chairman BROOKS. Thank you, Dr. Altenkirch.

The Chair is going to exercise his prerogative to have a second round of questions for both Mr. Lipinski and myself. But at this point, I am going to defer to Mr. Lipinski from the great State of Illinois for questions that he may have.

Mr. LIPINSKI. Thank you, Chairman Brooks.

I sometimes have—this is an area that is of great interest to me, and I also have to admit that I have two degrees in engineering. I left the STEM fields. I had one colleague of mine say during a hearing once that I went to the dark side. I got a Ph.D. in political science.

Chairman BROOKS. But it was from a good university.

Mr. LIPINSKI. Yes, Duke University. I think that is a pretty good university.

But as we are going through this, my mind is going in a million different directions. Let me see if I can narrow this down to a few specific questions.

I want to start with Dr. Lamb. Is there anything—and I am not suggesting—I am not just playing the role of the Democrat here and suggesting that the Federal Government does everything, but what we are here about is what we do in Congress, what can the Federal Government do.

So first, what can the Federal Government do, if anything, to promote more entities like the HudsonAlpha Institute? Is there anything that can be done to promote such entities?

Dr. LAMB. Aside from providing financial incentives for groups to enter into this field?

Mr. LIPINSKI. Whatever you —

Dr. LAMB. So let me start by commenting on what you just said about your own personal history, about starting with a STEM field and then moving out. There is a recent study by Georgetown University that notes that there is this big discussion that we are losing individuals in the STEM arena, we don't have enough STEM workers. The Georgetown study noted that we actually start out with enough STEM workers, but they are pushed away to other fields because our STEM students display the important skills that other industries and other companies need. So I would posit that your STEM background actually provided you a great foundation for moving over.

Mr. LIPINSKI. I like to state that all the time. I think that we have less than 10 engineers in Congress, and we could use a lot more. I won't say anything about what we could use a lot less of, but there are over 250 attorneys.

[Laughter.]

Chairman BROOKS. Would it help that my father and two sons are engineers? Do I get some credit for that?

Mr. LIPINSKI. Yes, you get a lot of credit for that.

Dr. LAMB. That is right. Those who grow up in STEM households, I think you also imbibe that as well.

I think that one of the most important ways—and this is true for industry as well. One of the most important roles for industry and non-profit is recognizing that they are content experts and that they have a very important role to play in informing education, linking what students are learning with real-world applications.

Mr. LIPINSKI. Let me roll into my next question. Is there anything the Federal Government can do to encourage the collaboration you talked about? This is something that I have always emphasized and I never see enough of. I was teaching political science, and I did not see universities doing enough to interact with industry. I don't see enough of—and it seems that this is coming on a little bit more, but we have the Department of Energy, national labs, a couple in the Chicago area, the universities. I always encourage them to collaborate, taking the research that is being done, industry taking that, creating products, jobs. That is our future. But also collaboration with all levels of education and industry, the Federal Government, whether it is the energy labs or NASA. I know NASA does a lot of work on this, but more needs to be done.

So what can be done to entice and encourage, incentivize this type of cooperation? I think this is something that everyone probably may have an answer to.

Dr. LAMB. I think that there should be requirements in funding opportunities when groups write funding proposals. There should be requirements to make sure that industry and education are at the same table, and I think those can be funding requirements for education-related grants as well as things like small business grants, that there is a connection to education.

But I think you have to be very specific. This needs to be more than simply having them at the same table, having someone write on a proposal, "Yes, I have this advisory committee, and look, it involves people from industry and it involves people from education." We need to spell out what these partnerships potentially can look like.

These are not easy to develop. They do not naturally flow. We often speak different languages. We often come with different perspectives. People in industry and non-profit generally do not have any sense of the challenges from the world of education. It is a different language. It is a different set of backgrounds. And it takes time. It takes much more time than simply showing up at a quarterly meeting where we all have a boxed lunch and we nod at each other.

I am not sure how you actually try to knit these groups together, but there needs to be a better expectation of what these partnerships potentially can look like. They can be incredibly fulfilling, and once you begin to build them, then other ideas and projects flow naturally out of them, and it becomes very engaging and encouraging on both ends.

But it is not always easy to get them to the table and to get them on the same page.

Mr. LIPINSKI. Anyone else have anything they can add about how we can encourage the collaboration?

Dr. WRIGHT. Well, you asked about what the Federal Government could do, and I would like to emphasize that if we had a de-

creased focus on accountability—for example, with No Child Left Behind, there has been such a focus on the reading and math, and even though it is probably an unintended consequence, it causes us to put our resources in areas that are singularly focused, as opposed to broad-based programs that really do integrate and apply the knowledge that we are learning.

So when there is legislation that causes that kind of singular focus, I think that is something that we need to take a look at and try to—whatever the legislation is, that is what we are going to do. So as an unintended consequence, that is where the money is going to go. So if we can put our money—if we can have federal legislation that really focuses on the integration of the academic, as opposed to a singular focus of passing some level of reading.

Dr. LAMB. And if I could add, I think in adding to Dr. Wright's point, AYP has intentionally put the focus on math and reading to the exclusion of science. So in many of our schools, science has been shifted off to the side or is used as a way to teach, to remediate in math and reading, with very little science focus, and I think that has done enormous harm to how we look at science and how we teach science in our schools across the country.

Mr. LIPINSKI. If I could go on to another question here, I am always looking to the Chairman as to when he is going to pull the plug on this round, but let do one more question.

Dr. Beck, how many of the students who receive Associates degrees, what will they do with Associates degrees in these STEM fields? How many of them will go into—can get a job with that in a STEM field? How many go on to a four-year degree—finish up and go on to a Bachelor's degree? What are you seeing in that regard?

Because the big question that came up, and I probably shouldn't attach it to another one, but I think we have to look at the whole breadth here. The question is, what do students need to learn? And there are different types of jobs. That was brought up. There are different types of jobs that you have. There are some STEM jobs that you just need an Associate's degree for, there are some STEM jobs you need a Ph.D. for, and there is a real—it depends. Not everyone is—we are not teaching STEM, just the way one goes to get a Ph.D. in STEM. That is not what we want, that is not what we need.

But how many of them, how many students—and has there been an increase in the number of students who get an Associate's degree in a STEM field that can step right in? Are there more jobs available for them or not?

Dr. BECK. At Calhoun, about a third of our students are coming to the college to upgrade skills or to re-skill. About a third of the students are seeking an Associate's degree in a variety of fields with the intent to go into the labor force. The other third are transfer students. They intend to transfer to the college and universities.

We find that our students who are in the health careers and the technology careers that involve STEM fields get jobs in our community. In fact, one of the issues we have is that some of the students who are really good students and who acquire technical skills may opt out for a job before they complete their Associate degree. So we are working very hard to keep them associated with the college

even though they have gone to work so that they will complete their Associate degree.

Our students in the transfer curriculums, when they transfer we get data from UA–Huntsville and other universities. They do as well or better when they transfer as the native students do at the university. So they are pretty well prepared.

Our two-year degree students, as I said, in the STEM areas are almost 100 percent placement. If they just stop out after they have completed two years of a possible Gen Ed or transfer curriculum, they have challenges in the job market. They have a two-year degree but their skills don't enable them to compete as effectively in this workforce. But our students that are in that upper third do go on to the universities at a high rate, and they do pursue Master's and Doctor's degrees in the various STEM and other fields.

Mr. LIPINSKI. Thank you.

Chairman BROOKS. As you are probably aware, our youth have faced significant challenges with the unemployment rate, and for folks who are in their upper teens or low 20s, there is a very significant disparity between their unemployment rate and the rest of the Nation as a whole, and this is for any witness who may want to address this.

Can you explain to the best of your ability why many students graduate in STEM fields and yet still are unable to find jobs, even though the United States is a leader in science and technology, and efforts to educate our students in STEM fields are well underway? Would you attribute this to our Nation's current economic conditions or to an actual lack of STEM opportunities?

Mr. PARTYNSKI. I will take a stab at that, since industry does most of the hiring for STEM-educated students.

I believe a major factor currently is the economy. There are periods in our history where we can't graduate enough STEM students. I remember that when I graduated, I had 12 job offers before I finished school. I have a son who is going to graduate this year, and he doesn't have any job offers yet.

The challenge that I am learning is really a problem is education alone today isn't enough. Experience is necessary. So co-ops, internships, some level of experience in the field that they are interested in is critical. So that is the challenge. The economy is the driver, and the desire today is to have people with some level of experience.

Chairman BROOKS. While I have you, Mr. Partynski, do you have a judgment as to whether those individuals who graduate in the STEM fields are doing any better or worse than community and university graduates who have degrees in non-STEM fields?

Mr. PARTYNSKI. Unfortunately, I can't answer for non-STEM fields since our primary focus is in the sciences. But my opinion is that the challenge is even larger for those that aren't graduating in the STEM fields, again owing to the economy.

Chairman BROOKS. And perhaps one of the folks who are in higher ed can address that to a greater degree. But notwithstanding, would any of you all be in a position to respond to either the first question or the follow-up?

Dr. ALTENKIRCH. I don't suspect that the jobless rate among graduates in the STEM fields is greater than the average. I would

suspect that it is less because of the fact that if you are prepared in those subject areas, you are able to do those subject areas, but you are also able to do a lot more. So you are educated in problem-solving, whereas if you opted out of those fields, I think your opportunities are limited. Congressman Lipinski was well prepared to get a Ph.D. in political science.

So I think my point is that the engineering and mathematics and science fields are really broad based and allow you to do a lot of things. I don't think that the graduates should limit their horizons to "if I get an engineering degree, I have to do engineering." I think it is much more open than that.

Chairman BROOKS. Dr. Wright, Dr. Beck or Dr. Lamb, do you all have any insight you wish to share on either the first or the second question?

Dr. WRIGHT. We find it—we have limited data, but we find it quite interesting that our students at Bob Jones, we have 88 percent that go to college, and of that 88 percent we have about 56 percent who actually get a four-year degree in five years. You see on the news the high cost of student loans.

So we have seen, in the limited amount of time that we have had these career tech programs in the STEM fields, that students who do the level three or level four internship—so if you have a biomedical student in year four that is doing those internships in different areas, or the engineering student who is out at SAIC seeing what the opportunities are, they are much more likely to go to college and finish a four-year degree in four years or five years than their counterpart who hasn't done that.

So again, it is limited data, but we really feel like those students who have an opportunity to have hands-on application of the learning are much more prepared and are going through college at a faster rate because they know what they want to do, because they have seen all those opportunities out there. So we feel like that has been a strong point here.

Chairman BROOKS. Dr. Beck or Dr. Lamb, do you have anything you wish to add?

Dr. LAMB. The Georgetown study that I mentioned earlier has actually found that there is a lower unemployment rate for individuals that are STEM graduates, in part because they tend to be poached by other industries based on the skill sets that they have developed that translate so well.

We run a summer intern program at HudsonAlpha. We bring about 30 interns in at the high school and undergraduate level from across the state, and we have over 300 applicants routinely for these 30 positions. The words that we hear over and over are "I have to have hands-on experience to make me more attractive as a job candidate." So I think that that is what separates many of these students from who rises to the top of the stack, who has hands-on experience, and I think we have to do a better job of providing more of those real-world opportunities for our students.

Chairman BROOKS. Mr. Partynski, I have your written remarks which, as is normally the case, differ from your oral remarks because of time limitations, and I am going to read from a part of it. It says, "The 2010 American Community Survey performed by the Census confirms that the Huntsville metro area has the high-

est per capita concentration of engineers in the country, with 11,392 engineers making up six percent of the total employed residents. San Jose/Sunnyvale/Santa Clara is second at 5.1 percent.” So we are at 6, they are at 5.1.

SAIC is in somewhat of an interesting position because you are in business, of course, to make a profit for the owners of the business. That is what free enterprise and capitalism is all about. Nonetheless, you all seem to be diverting some of your profits or resources to STEM efforts.

Can you share with us what the cost is to SAIC of engaging in STEM efforts that, at least on the surface, have no apparent direct profit motive to SAIC? And then finally, why does SAIC do it? What is the benefit?

Mr. PARTYNSKI. Well, it will be hard for me to give you an exact number of what our investment is. I can give you one example. We nationally sponsored Project Lead the Way and First Robotics at \$1 million, and that is just because of our interest in that area.

What was the second part of your question?

Chairman BROOKS. What is the benefit to SAIC? What is the motivation for you to invest this money that you do not get a direct return on?

Mr. PARTYNSKI. Well, actually, it is an investment in the future. The motivation is to actually stimulate the growth of a segment of our market that we see need in the future. We cannot graduate enough U.S. citizens with advanced degrees to fill the needs that we are projecting for national security in the future. So we have a long-term vision on the needs of what this nation needs to provide, and we see a shortage. Therefore, we are investing in our own future.

Chairman BROOKS. And is SAIC, in your experience, alone in this endeavor, or do your competitors also participate, as SAIC does, in this investment in STEM education?

Mr. PARTYNSKI. Well, from the folks that I have talked to, it is a communitywide effort. It is not a single company. All the companies, at least in the Huntsville area, are contributing, are doing STEM initiatives of their own in a very big way. As a matter of fact, in answer to Congressman Lipinski’s question earlier, what can the government do, as a matter of fact we are showing kind of a dichotomy here. We are saying that STEM is important, the government wants to promote STEM, but yet the government has cut back on all R&D spending.

If you think about where a lot of the STEM workforce goes, it is into R&D. So one of the things the government can do maybe is to relook at the cuts in research and development spending across the board.

One of the biggest challenges in research and development is that it is research. It isn’t a product development. When you do research, you can’t be penalized for failure. As a matter of fact, you may find success in finding a way to show how not to do something as opposed to always showing that this is how you do it.

So there needs to be a different thought process in how we perceive research and development, how we account for the results of research and development, and the amount of funding that we are

providing for it, because that is what drives the entire technical market.

Chairman BROOKS. Thank you, Mr. Partynski.

At this time, the Chair will defer to Mr. Lipinski for the final set of questions.

Mr. LIPINSKI. Thank you. I want to thank Mr. Partynski, first of all, for emphasizing the importance of federal funding for R&D. I think that is very critical for the future of our country. I also want to thank you and SAIC for what you do, and that is part of we are fortunate that we do have private industry, we do have non-profits who are willing to make that investment, because it is obviously not going to all come from government. It shouldn't come all from government. But it is a special role that you play in doing that, in helping our nation.

It is funny that the Chairman just read off that paragraph from Mr. Partynski's written statement. I had circled that earlier on. I was going to say that is why I felt so welcomed here in Huntsville, is all of the engineers. Seeing as it is the highest per capita engineers, I now completely understand that.

I want to ask—well, let me say this before I ask my one final question. I want to thank Chairman Brooks. I want to thank Mo and his wife, Martha, for their hospitality here. My wife, Judy, and I very much enjoyed our time here, not just because it was 30 degrees warmer here than in Chicago right now, but very much enjoyed, had a good time down here, and I look forward to coming back to visit.

I had questioned—I have been to 45 or 46 states, and I was never sure if I could count Alabama. I drove through a corner of Alabama once. I don't think I ever set foot in the State before. But I will be back here, and I want to thank everyone here, and our witnesses, for being here today.

My last question is the importance of K-12 educators in STEM certainly has been emphasized, so what can we do to have better—to reward the good STEM educators, to encourage more good people to come in and be STEM educators in K-12? I mean, that is a big question that we have out here. What really can we do to make that possible?

I think Dr. Wright may want to start, and then we will hear what anyone else has to say on that.

Mr. PARTYNSKI. Well, I will start because I don't have a vested interest in education because I am in industry, but we all have a vested interest in education as a Nation.

The challenge I see for educators is continuously shrinking budgets. One of the things that I find perplexing is we have mandated requirements without funding which drives educational institutions to cut programs, to cut things that they used to do in teaching in order to meet those requirements.

And so again, it boils down to available funding, and I think most educational institutions and communities are underfunded at this point. I think if we provided them adequate funding, they would really excel at what they do.

Dr. WRIGHT. Hear, hear.

I think the other issue is you have got to attract good people, but then once you have good people, you have got to sustain their

training. So we have great teachers on staff, but we need the funding for current technology so that they can integrate the current technology and stay abreast of what has happened, and that is the biggest challenge that we have, is we want them in the classroom teaching, but how do we keep them trained in current technologies and industry standards.

So partnering with business and industry for our teachers' sake so that they can get into business and industry and find out what industry standards are is a real need because I think, again, we need to invest in those people that we currently have, in addition to attracting others. We have a bright, bright teaching force here in Madison City, but there is still that constant problem of how do you keep them current, how do you keep them current.

So repositories of information that they can go to to learn, which could be developed at the federal level or the State level, and then obviously the money to be able to help them with their training. Online and Web resources are so great now, but finding enough time and giving them opportunities to do that is a challenge.

So I think we have got to train and retrain the people that we do have, in addition to attracting the new folks.

Dr. ALTENKIRCH. I think, too, on the training or education side, it is important to realize that if you are going to teach a subject, you have to know where it is going to lead you. So, for example, for people who teach algebra, they have to know much more than algebra because they have to know where algebra is going to take you. Algebra is not an end in and of itself. I am not convinced that all of the STEM teachers in the classroom have that sort of perspective or that education or training that is beyond what they are teaching, and I think that is very important. Otherwise, everything seems so compartmentalized and so much of an end in and of itself that you can't see the big picture, and working in industry, you have to be able to integrate all these things on large-scale projects.

Mr. LIPINSKI. Anyone else? Dr. Beck?

Dr. BECK. I personally went to school in mathematics from the baccalaureate degree to the doctorate with scholarships, and had it not been for those programs at that time, which is post-Sputnik, I probably wouldn't have been able to complete those degrees.

So I say that to say that we really do need scholarship money for STEM students. We have a grant right now at the college, a \$450,000 grant for four years, but we could probably use three times that much to recruit the good students into the STEM fields. The good students can choose any field because they are capable, but the scholarship funds will influence them and encourage them into the STEM fields.

Then beyond that, the graduate scholarships to train teachers to teach mathematics so that they indeed do have training well above the skills that they are teaching in the high schools. And then second, the information about professional development. Even after they are trained and get their degrees, they must continue to be updated in their fields to be fine teachers.

Dr. LAMB. Just to round out the panel, I think we have to find ways to reduce the barriers between individuals in industry who are into education and individuals in education to understand the concepts from industry.

So you have heard bits and pieces of that already. We want to recruit individuals from our STEM industries to come into the classroom, but we put an enormous number of educational barriers in front of them. Certainly I am not saying that you should be able to take someone straight out of industry and plop them right in the middle of a classroom, but there are a number of incredible challenges, both financial and in terms of their time and their required course work, that right now stand in their way that cause many of them to pause before they decide they want to go into education.

And on the flip side, I think we have to find ways for industry and for non-profits to learn to package information about real-world applications in ways that classroom teachers can grasp them, so that the algebra teacher understands how algebra gets used in a host of other ways, and so that the biology teacher who got his or her degree 20 years ago is able to be updated on all the new discoveries and how this is important and how this links back to the careers.

It is about reducing the boundaries and about increasing the communication between both sides of that equation.

Mr. LIPINSKI. Thank you. I thank all our witnesses here today, and I also just want to—I should have said this at the beginning, but I think this shows that there are critical issues that are facing our country, and I believe we need to work together, and we showed here today we are Democrat and Republican, we are not fighting, we are working together, and I want to thank Mo Brooks for, as he took this position as Chair of the Subcommittee, being willing to do that, and it is a pleasure to work with him as we work together to try to solve, do what we can to try to solve some of these big problems.

Chairman BROOKS. I would like to thank all the witnesses for your valuable testimony and insight, and Congressman Lipinski for his participation and questions. I would also like to thank Bob Jones High School and the City of Madison for being such wonderful hosts for this Congressional hearing in the Fifth Congressional District of Alabama, which could very well be one of the first, if not the first, in the Tennessee Valley, certainly the first in the City of Madison.

I also want to thank our Committee staff and my Congressional staff. They had some hard choices to make, as you can see from this panel, some excellent individuals. We have an abundance of talent in the Tennessee Valley that we could have selected here in order to glean the insight and expertise. There are so many different folks. It could have been people from NASA and the Marshall Space Flight Center, any of our national defense commands, any other entities that are in the private sector. It could have been the Space and Rocket Center, Side Quest, non-profits, you name it.

But the panel that we have representing K-12 and the community colleges and higher institutions, four-year colleges on the one hand, industry and then hybrid research and industry on the other, I think that was a good combination, given the issues that we face with STEM nationally and what we have to do to make sure that America continues to be number one in STEM education, which, in turn, has made us number one in exceptionalism.

The Members of the Subcommittee may have additional questions for any one of you, and we will ask you to respond to those in writing, not just the two that came but others who are on the Committee. The record will remain open for two weeks for additional comments from the Members.

Chairman BROOKS. The witnesses are excused, and this hearing is adjourned.

[Whereupon, at 11:50 a.m., the Subcommittee was adjourned.]

ANSWERS TO POST-HEARING QUESTIONS



Madison City Schools Congressional Field Hearing Testimony

Follow Up Questions

June 11, 2012

1. **You have established great partnerships, not only with the other witnesses, but also with other local, regional, state, and federal government and non-government entities. Which partnerships proved to be the most challenging to form? Why were they challenging, and how were you able to overcome them?**

Madison City Schools do have great partnerships with many local, state and federal government entities. A few examples include the following: School Resource Officer support from the local police department, "Blessings in a Backpack" weekend food resources for needy children prepared by area churches, grants from the state legislative delegation for urgent school needs, student internships from NASA and many enrichment resources and support from Redstone Arsenal. These partnerships formations did not have any particular challenges in that most were offered or were gladly reciprocated.

The only real challenge we have faced in partnering with both government and non-governmental agencies is finding a way to communicate our needs, most specifically for student internships and teacher job shadowing, for our career and technical programs. Matching our school district needs with government and non-government entities' proffering of opportunities is very time consuming. We need a full time employee to be a community resource agent to increase the awareness of our needs. However, to assist with this we have developed an advisory committee of business, industry, and governmental leaders who have taken on the task of making connections and creating a repertoire of potential opportunities for partnerships. These individuals will act as a liaison between the school system and the outside agencies. We anticipate that this will alleviate this obstacle of communication.

2. **What are the most successful and effective STEM education efforts being implemented in the Madison City Schools?**

The most successful and effective STEM education efforts being implemented in the Madison City Schools are through our academies at the secondary level and AMSTI in the elementary grades.

In grades 9-12 we have developed career academies through Career and Technical Education. These academies are broad based programs and are for ALL students. Our most successful programs are in the STEM areas and include Engineering, Health Science, and Biomedical. In these programs students will take the first, entry level course, in grade nine or ten. The courses are designed to give students a broad array of experiences in the career cluster and help them

apply the academics they are learning in the classroom. In the first year, guest speakers tell of the many job opportunities that exist in the field.

In year two, students often have job shadowing opportunities and really begin to focus on the areas of study they most enjoy. Depending on the rigor of other academic courses in their schedule, from Advance Placement courses to general education courses, students begin to specialize more in areas that align to their academics. For example, if they are planning to be a veterinarian or a medical doctor, the students will have courses such as AP Chemistry, AP Latin, and AP Calculus. If they are more suited for a Emergency Medical Technician or a Dental Assistant, their academic schedule may include regular chemistry, Spanish, and Algebra II with Trigonometry. But regardless of their future plans, students take the same career tech course.

In year three or four, depending on the academy, students hone their skills and technical rigor. They begin to focus on their particular area of interest. For part of the semester, students participate in an internship with a business or industry aligned to their area of interest. In the engineering academy we had 60 students this year participate in an internship in one of about 40 government and non-governmental entities. These include NASA, Raytheon, SAIC, Hudson Alpha, and Redstone. Biomedical and Health Science students intern with Huntsville Hospital, Crestwood, and many other medical facilities. We believe that when students have hands-on opportunities to practice their academics and align their skills with future job opportunities, whether those opportunities begin after high school or after two, four, or eight years of college, they will be better prepared and will leave our district college and career ready.

The elementary principals and teachers plan and provide instruction through the premise that students learn math and science best by doing math and science, especially when they are able to relate it to their daily lives. Through AMSTI professional development these professionals have a deepening of content knowledge and teaching specific instructional strategies. The teachers participate in activities that they will use with their students. Each AMSTI teacher receives 120 contact hours of subject and grade specific professional development during the Summer Institutes. AMSTI also assist teachers in learning various ways of assessing student performance. Trainers model instruction, so the teachers are taught in the same manner in which they are expected to teach. Trainers at the Summer Institute are master teachers who have been certified by the State Department of Education. AMSTI supplies basic equipment and materials needed to engage their students in hands-on, activity-based instruction ranges from plastic cups and cotton balls to cutting edge technology like mass spectrophotometers, DNA replicators; gel electrophoresis equipment, graphing calculators, GPS devices, and nuclear scalars. The resources are organized in unit tubs referred to as "kits." It is a challenge to find funds to replenish these kits and even greater funding challenge to provide the much needed technology to support this innovative STEM strategy.

Full-time AMSTI math and science specialists from the University of Alabama Huntsville mentor the teachers in their classrooms until the newly trained teachers become comfortable with the "AMSTI way" of teaching. Each AMSTI site is partnered with an institute of higher education (university/college). This partnership facilitates the involvement of university faculty with K-12 teachers. AMSTI can be described as providing three key services of professional development, equipment and materials, and on-site support. All AMSTI Schools have designated math and science Lead Teachers that receive additional training, allowing them to assist other teachers when AMSTI specialists are not at the school. All AMSTI Schools also have an AMSTI School Implementation Team that works to ensure the initiative is being successfully

implemented. Teachers within each school are organized into Learning Teams that meet to share ideas and ensure all teachers continue to grow professionally. AMSTI Site specialists and directors also provide teachers and administrators additional professional development during the school year.

Question submitted by Chairman Mo Brooks for Dr. Altenkirch

1) You have established great partnerships, not only with other witnesses, but also with other local, regional, state and federal government and non-government entities. Which partnerships provided to be the most challenging to form? Why were they challenging and how were you able to overcome them?

We are finding enthusiastic partners to enhance STEM education, so the motivation of everyone who is involved is positive. Education and business speak different “languages.” It’s the interpretation of “languages” that can be a stumbling block. Education and business have expectations for performance and accountability with lessons to learn from each group but also are areas where challenges form. Various partners gather around the table and begin the conversation of which direction to take. That is where we must work harder to speak a common “language” and collaborate. Workforce development needs of such a complex economy adds to the task. Methods used to execute ideas on how to best prepare students to meet needs at times provide even more challenges.

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON RESEARCH AND SCIENCE EDUCATION

*STEM Education in Action: Local Schools, Non-Profits, and businesses Doing Their Part
To Secure America's Future*

Monday, April 30, 2012
10:00 a.m.

**Questions for the Record Submitted to Dr. Marilyn c. Beck,
President, Calhoun Community College**

Question Submitted by Chairman Mo Brooks

1. You have established great partnerships, not only with the other witnesses, but also with other local, regional, state, and federal government and non-government entities. Which partnerships proved to be the most challenging to form? Why were they challenging, and how were you able to overcome them?

Answer: The most challenging partnerships are with the federal government. The greatest challenges are communication and compliance with numerous federal regulations. Communication is difficult because of the different languages used by education and government. Government officials seem to "speak in acronyms" which is a new language for educators. Study and continued communication slowly eliminate this barrier.

Federal government policies and procedures are so different from state ones that negotiating budgets and meeting federal regulations poses a real challenge. We have found that hiring an employee in our Business Office with experiences in both state and federal government creates a bridge for overcoming this challenge.

HOUSE COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
 SUBCOMMITTEE ON RESEARCH AND SCIENCE EDUCATION

STEM Education in Action: Local Schools, Non-Profits and Businesses Doing Their Part to Secure America's Future
 Monday, April 30, 2012

Answers to Questions for the Record Submitted to Dr. Neil Lamb

1. You have established great partnerships, not only with the other witnesses, but also with other local, regional, state and federal government and non-government entities. Which partnerships proved to be the most challenging to form? Why were they challenging and how were you able to overcome them?

The most challenging partnership was our first – with the Alabama Math Science and Technology Initiative (AMSTI) through the Alabama Department of Education. The challenge stems from the timing of the partnership – HudsonAlpha was a brand new entity, virtually unknown and with no track record. At the same time, AMSTI was a growing program, working on statewide expansion. There were many groups coming to AMSTI to pitch their programs or kits – usually with significant financial costs. AMSTI had learned to be wary of people offering collaborations without showing their value and stewardship. As a result, they met our initial discussions with a healthy dose of skepticism. HudsonAlpha had to prove that we could develop activities that engaged students, filled a gap in the menu of kits and were embraced by classroom educators – we had to earn AMSTI's trust. This involved an ongoing series of discussions, pilot tests and a willingness on both sides to listen. I'm very pleased with those initial middle school activities – they opened the door to a long-term relationship based on mutual respect, communication and a shared desire to improve the science education of Alabama students. Our partnership with AMSTI provided the credibility to launch other collaborations on a local, regional and national level.

2. HudsonAlpha is doing everything from lab kits to iPhone apps to promote STEM education. I understand the need to fill your future workforce, but what are some of the other factors HudsonAlpha takes into consideration when supporting STEM education?

HudsonAlpha seeks to provide educational programs and opportunities across the lifespan – literally from “PreK to Gray”. However, we strive to avoid recreating the wheel and mimicking existing successful STEM educational programs. Consequently, we often begin discussion of a potential new program by determining if the activity will meet an existing need or gap in education that is not currently met by others. If we are working in the formal K-12 education arena, we then look at how the activity would meet existing national and state course of study standards. We have learned that if a program cannot be tied to a state curriculum requirement, it will be very hard for an educator to introduce it into his or her classroom. Connecting to study standards also helps educators identify placement and fit into a given class.

HudsonAlpha also explores whether the program illustrates a content topic or the application of that topic. Ideally, we strive to develop activities that accomplish both, tying the learning of a concept to understanding how it is used in life. We also investigate the feasibility of carrying out the potential program in a variety of classroom settings – from the small, rural class to the inner-city or suburbs. Sometimes the most outstanding activity will only benefit a tiny fraction of students. While that doesn't mean the activity isn't worth developing, that metric does play a role in the amount of time, resources and energy we may devote towards its creation.

House Committee on Science, Space, and Technology Subcommittee on Research and Science Education

Stem Education in Action: Local Schools, Non-Profits, and Business Doing Their part to Secure America's Future.

Monday, April 30, 2012

10:00 AM

Question for the Record Submitted to Mr. Andrew Partynski, Chief Technology Officer, SAIC

1. You have established great partnerships, not only with other witnesses, but also with other local, regional, state, and federal government and non-government entities. Which partnership proved to be the most challenging to form? Why were they challenging and how were you able to overcome them.

Answer: Of the organizations we work with the most challenging are the three local public school systems in Madison County. Each system and every individual school has unique challenges that require time and creativity to overcome. As stated in my testimony on 30 April 2012 the way SAIC approaches all STEM efforts is with the volunteerism of our people leveraging their passion and creativity to address issues individually and then consolidate several of them to create a more significant strategic thrust. One example of this approach is the recent deployment of the CyberNEXS curriculum on cyber security in Huntsville City Schools as well as our Project Lead the Way efforts throughout Madison County. Our company's unified approach has to be adjusted slightly for each individual system based on their unique requirements. Additionally, another challenge is coordinating a unified effort working with other companies in the community. Just as SAIC has unique requirements and processes – other companies have their own set of processes as well. This can present challenges and requires great effort and sensitivities to the goals of other corporations and their corporate image of leadership as well.