

**AMERICA COMPETES: BIG PICTURE PERSPECTIVES
ON THE NEED FOR INNOVATION,
INVESTMENTS IN R&D, AND A COMMITMENT
TO STEM EDUCATION**

HEARING
BEFORE THE
**COMMITTEE ON SCIENCE AND
TECHNOLOGY**
HOUSE OF REPRESENTATIVES
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AMERICA COMPETES: BIG PICTURE PERSPECTIVES ON THE NEED FOR INNOVATION, INVESTMENTS IN R&D, AND A COMMITMENT TO STEM EDUCATION

WEDNESDAY, JANUARY 20, 2010

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
Washington, DC.

The Committee met, pursuant to call, at 10:06 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Bart Gordon [Chairman of the Committee] presiding.

HEARING CHARTER

**U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY**

**America COMPETES: Big Picture Perspectives
on the Need for Innovation, Investments in R&D
and a Commitment to STEM Education**

WEDNESDAY, JANUARY 20, 2010
10:00 A.M.—12:00 P.M.
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1. Purpose

On Wednesday, January 20, 2010, the House Committee on Science and Technology will hold a hearing entitled “America COMPETES: Big Picture Perspectives on the Need for Innovation, Investments in R&D and a Commitment to STEM Education.” The purpose of the hearing is to examine the role that science and technology play in promoting economic security and maintaining U.S. competitiveness and to understand the perspective of the business community on the reauthorization of the *America COMPETES Act*.

Witnesses were asked to provide testimony on ways to build upon the *America COMPETES Act* to further strengthen U.S. competitiveness. Witnesses were asked specifically to discuss how the programs authorized in the *America COMPETES Act* have affected or will affect innovation and the ability to maintain a skilled workforce in the United States, and whether the priorities and focus of the *America COMPETES Act* will put the U.S. on course to maintain its ability to compete successfully in the global economy.

2. Witnesses

- **Mr. John Castellani**—President, Business Roundtable
- **Mr. Tom Donohue**—President, U.S. Chamber of Commerce
- **Governor John Engler**—President, National Association of Manufacturers
- **Ms. Deborah Wince-Smith**—President and CEO, Council on Competitiveness

3. Background

It is widely recognized that scientific advancement and technological innovation have contributed to economic growth in the United States. In fact, some economists estimate that about half of economic growth in the United States since World War II has been the result of technological innovation. At the same time, the Organisation for Economic Co-operation and Development (OECD) concluded that, since World War II, leadership in science and engineering in the United States has driven its dominant strategic position, economic advantages, and quality of life.

Although the United States continues to be a world leader in research and development, technological innovation, and science and mathematics education, there is indication that this leadership is slipping. For example, between 1990 and 2001, the United States trade surplus in high technology products turned into a trade deficit. In addition, in recent years, American students have been performing poorly on international assessments of math and science proficiency and a growing number of American companies have moved assets and jobs overseas.

On October 12, 2005, the National Academy of Sciences’ Committee on Prospering in the Global Economy of the 21st Century released a report entitled *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*. The report was prompted by a request to the National Academies from Chairman Bart Gordon, former Chairman Sherwood Boehlert, and Senators Lamar Alexander and Jeff Bingaman to identify the top 10 actions, in priority order, that Federal policymakers could take to enhance the science and technology enterprise so that the United States can successfully compete, prosper, and be secure in the global community of the 21st century.

The *Rising Above the Gathering Storm* report offered four recommendations, with specific action items for implementation. The recommendations were:

- **Recommendation A:** Increase America's talent pool by vastly improving K–12 science and mathematics education.
- **Recommendation B:** Sustain and strengthen the nation's traditional commitment to long-term basic research that has the potential to be transformational to maintain the flow of new ideas that fuel the economy, provide security, and enhance the quality of life.
- **Recommendation C:** Make the United States the most attractive setting in which to study and perform research so that we can develop, recruit and retain the best and brightest students, scientists, and engineers from within the United States and throughout the world.
- **Recommendation D:** Ensure that the United States is the premier place in the world to innovate; invest in downstream activities such as manufacturing and marketing; and create high-paying jobs based on innovation by such actions as modernizing the patent system, realigning tax policies to encourage innovation, and ensuring affordable broadband access.

In August of 2007, the *America COMPETES Act* passed the House of Representatives by a vote of 367–57 and was signed into law by President George W. Bush. The bill, which was the culmination of a lengthy bipartisan effort by Members of the Science and Technology Committee, implemented many of the recommendations of the *Rising Above the Gathering Storm* report. Among other things, it increased funding for basic research by putting funding for the National Science Foundation, the National Institute of Standards and Technology, and the Department of Energy's Office of Science on a path to doubling and increased investment in science, technology, engineering and mathematics (STEM) education. The legislation was endorsed by a wide range of stakeholders, including the U.S. Chamber of Commerce, the National Association of Manufacturers, Business Roundtable, and the Council on Competitiveness.

Many of the provisions and programs in the *America COMPETES Act* are set to expire at the end of Fiscal Year 2010 and must be reauthorized.

4. Summary of *America COMPETES Act*

TITLE I—Office of Science and Technology Policy (OSTP)/Government Wide Science

The legislation directed the President to convene a National Science and Technology Summit to examine the health and direction of the U.S. STEM enterprise; required a National Academy of Sciences study on barriers to innovation; changed the National Technology Medal to the National Technology and Innovation Medal; established a President's Council on Innovation and Competitiveness; required prioritization of planning for major research facilities and instrumentation nationwide through the National Science and Technology Council; and expressed a sense of Congress that each Federal research agency should support and promote innovation through funding for high-risk, high-reward research.

TITLE II—National Aeronautics and Space Administration

The legislation established the National Aeronautics and Space Administration (NASA) as a full participant in all interagency activities to promote competitiveness and innovation and to enhance science, technology, engineering and mathematics education. The legislation affirmed the importance of NASA's aeronautics program to innovation and to the competitiveness of the United States. It urged NASA to implement a program to address aging workforce issues at NASA and to utilize NASA's existing Undergraduate Student Research program to support basic research by undergraduates on subjects of relevance to NASA. The legislation also expressed the sense of Congress that the International Space Station (ISS) National Laboratory offers unique opportunities for educational activities and provides a unique resource for research and development in science, technology, and engineering which can enhance the global competitiveness of the U.S.

TITLE III—National Institute of Standards and Technology

The legislation authorized a total of \$2.652 billion over fiscal years 2008–2010 for NIST.

The legislation established a Manufacturing Extension Partnership (MEP) Advisory Board and required the Board to provide advice on MEP programs, plans, and policies; assessments of the soundness of the MEP plans and strategies; and assess-

ments of current performance against MEP program plans. It also established a program to award competitive grants among MEP Centers, or a consortium of Centers, for the development of projects to solve new or emerging manufacturing problems.

The legislation authorized a manufacturing research pilot grants program to make awards to partnerships that foster cost-shared collaborations among firms, educational and research institutions, state agencies, and nonprofit organizations in the development of innovative, multidisciplinary manufacturing technologies. It required such partnerships to include at least one manufacturing industry partner and one non-industry partner, and to conduct applied research to develop new manufacturing processes, techniques, or materials that would contribute to improved performance, productivity, and competitiveness of U.S. manufacturing.

The legislation established a program to award postdoctoral research fellowships at NIST for research activities related to manufacturing sciences and senior research fellowships to establish researchers in industry or at institutions of higher education who wish to pursue studies related to the manufacturing sciences at NIST.

The legislation created a new initiative called the Technology Innovation Program (TIP), which is based on the proven success of the Advanced Technology Program (ATP), but is focused on high-risk, high-reward, pre-competitive technology development through small- and medium-sized companies. TIP allowed for greater industry input in the operation of the program and allows university participation for the first time.

TITLE IV—National Oceanic and Atmospheric Administration

The legislation established a coordinated ocean, Great Lakes, coastal and atmospheric research and development program at the National Oceanic and Atmospheric Administration (NOAA) in consultation with the National Science Foundation (NSF) and NASA. The bill required NOAA to build upon existing educational programs and activities to enhance public awareness and understanding of the ocean, Great Lakes, and atmospheric science, and to develop a science education plan. It required NOAA to be a full participant in any interagency effort to promote innovation and economic competitiveness through basic scientific research and development and the promotion of science, technology, engineering, and mathematics education.

TITLE V—Department of Energy

The legislation provided nearly \$17 billion to Department of Energy (DOE) programs over fiscal years 2008–2010. It specifically authorized \$5.8 billion for the DOE Office of Science for Fiscal Year 2010.

The legislation also established an Advanced Research Projects Agency for Energy, or ARPA-E. ARPA-E will address long-term and high-risk technological barriers in energy through collaborative research and development that private industry or the DOE are not likely to undertake alone. ARPA-E is specifically structured to respond very quickly to energy research challenges, as well as terminate or restructure programs just as quickly. A fund is established in the U.S. Treasury, separate and distinct from DOE appropriations, for ARPA-E. The legislation authorized \$300 million in FY 2008, and such sums as are necessary thereafter for fiscal years 2009 and 2010.

The legislation provided \$150 million for K–12 STEM education programs that capitalize on the unique scientific and engineering resources of the national laboratories. These programs include a pilot program of grants to states to help establish or expand statewide specialty high schools in STEM education; a program to provide internship opportunities for middle and high-school students at the national labs, with priority given to students from high-needs schools; a program at each national lab to help establish a Center of Excellence in STEM education in at least one high-need public secondary school in each lab region in order to develop and disseminate best practices in STEM education; and a program to establish or expand summer institutes at the national labs and partner universities in order to improve the STEM content knowledge of K–12 teachers throughout the country. All of these programs are coordinated by a newly appointed Director for STEM Education at the Department, who also serves as an interagency liaison for K–12 STEM education.

The legislation highlighted the critical role of young investigators working in areas relevant to the mission of DOE by establishing an early career grant program for scientists at both universities and the national labs, and a graduate research fellowship program for outstanding graduate students in these fields. The legislation also brought attention to research and education needs in the nuclear sciences and hydrocarbon systems sciences by establishing grant programs to universities to establish or expand degree programs in these areas.

Finally, the legislation helped DOE recruit distinguished scientists to the national labs and foster collaboration between universities and the labs by providing competitive grants to support joint appointments between the two.

TITLE VI—Department of Education

To enhance teacher education in the STEM fields and critical foreign languages, the legislation authorized two new competitive grant programs. One program specifically enabled partnerships to implement courses of study in STEM fields and critical foreign language that lead to a baccalaureate degree with concurrent teacher certification. Another program implemented two- or three-year part-time master's degree programs in these areas for current teachers to improve their content knowledge and pedagogical skills. The legislation authorized \$151,200,000 for the baccalaureate degree program and \$125,000,000 for the master's degree program for fiscal year 2008 and the two succeeding fiscal years.

The legislation authorized competitive grants to increase the number of highly qualified teachers serving high-need schools and to expand access to AP and IB classes. It also authorized the Secretary of Education to contract with the National Academy of Sciences to convene a national panel within a year after the enactment of this Act to identify promising practices in the teaching of science, technology, engineering and mathematics in elementary and secondary schools.

The legislation authorized grants to states to implement mathematics programs or initiatives that are research-based, provide professional development and instructional leadership activities for teachers and administrators on the implementation of mathematics initiatives, and conduct student mathematics progress monitoring and identify areas in which students need help in learning mathematics. It also established a demonstration program which awards grants to states for the provision of summer learning grants to disadvantaged students. It also authorized grants to states to establish new service and activities to improve the overall mathematics performance of secondary school students.

The legislation also authorized a competitive grant program to increase the number of students studying critical foreign languages, starting in elementary school and continuing through postsecondary education programs.

The legislation also authorized competitive grants to states to promote better alignment of elementary and secondary education with the knowledge and skills needed to succeed in academic credit-bearing coursework in institutions of higher education, in the 21st century workforce and in the Armed Forces. It also authorized the Secretary of Education to award grants of \$50,000 to three elementary and 3 secondary schools, with a high concentration of low-income students in each state, whose students demonstrate the largest improvement in mathematics and science.

TITLE VII—National Science Foundation

The legislation provided \$22 billion to NSF over fiscal years 2008–2010. Particularly large increases were provided for K–12 STEM education programs. These programs, including the Noyce Teacher Scholarship program and the Math and Science Partnerships program, are geared to preparing thousands of new STEM teachers and provide current teachers with content and pedagogical expertise in their area of teaching.

The legislation increased support for the STEM talent expansion program (STEP) and the Advanced Technological Education (ATE) program in an effort to help create thousands of new STEM college graduates, including two-year college graduates.

The legislation provided support for young, innovative researchers by expanding the graduate research fellowships (GRF) and integrative graduate education and research traineeship (IGERT) programs, strengthening the early career grants (CAREER) program, and creating a new pilot program of seed grants for outstanding new investigators.

Finally, the legislation included provisions to help broaden participation in STEM fields at all levels. These include several programs of outreach and mentoring for women and minorities, a request for a National Academy of Sciences report to identify barriers to and opportunities for increasing the number of underrepresented minorities in STEM fields, and an emphasis on inclusion of students and teachers from high-needs schools.

TITLE VIII—General Provisions

The legislation required the Secretary of Commerce to report to Congress on the feasibility, cost and potential benefits of establishing a program to collect and study data on export and import of services; expressed a sense of the Senate that the Securities and Exchange Commission and the Public Company Accounting Oversight

Board should promulgate final regulations implementing the section of the Sarbanes-Oxley Act that are designed to reduce burdens on small businesses; directs the Government Accountability Office, after three years, to assess a representative sample of programs under this Act and make recommendations to ensure their effectiveness; expressed a sense of the Senate that Federal funds should not be provided to any organization or entity that advocates against a U.S. tax policy that is internationally competitive; directed a National Academy of Sciences study on the mechanisms and supports needed for an institution of higher education or non-profit organization to develop and maintain a program to provide free access to on-line educational content as part of a degree program, especially in science, technology, engineering, mathematics and foreign languages, without using Federal funds; expressed a sense of the Senate that deemed exports should safeguard U.S. national security and basic research and that the President and the Congress should consider the recommendations of the Deemed Exports Advisory Committee; and lastly, expressed a sense of the Senate that U.S. decision-makers should take the necessary steps for the U.S. to reclaim the preeminent position in the global financial services marketplace.

Chairman GORDON. This Committee will come to order. We would like to get things started here on time. Governor Engler is stuck in traffic. We have all had that situation, and he will be joining us shortly. Also, just so that you will know, he also has to leave at 11:30 and we will try to get everyone out of here by 11:30.

So good morning, and I am sure we will have some more that will be coming in later. Welcome, everyone. Before we start the hearing today, I want to quickly take care of a little bit of housekeeping, and I want to thank you all for having a productive last session and particularly for the subcommittees for all the work that you did. At your desk you will find an agenda for this coming year. On it says "draft." The reason that it says draft is that, you know, we welcome your continuing thoughts on that. Much of it reflects what we have been discussing over the last year.

And this morning we are going to kick off one of the most important efforts of the year, to reauthorize our Committee's landmark legislation, the America COMPETES Act. We will also reauthorize NASA [National Aeronautics and Space Administration] this year, setting up a path for the next 10 or 20 years, and Ms. Giffords and Mr. Olson are going to have their hands full putting that together for us, and we welcome that.

Among other initiatives, we also expect the Committee to take a closer look at advancing several energy technologies including those associated with nuclear energy, carbon capture and sequestration, marine and hydrokinetic energy, as well as energy efficiencies and conservation technologies. These technologies not only have the potential to help curb climate change, they also are poised to create new industries and new jobs to go along with them, and Mr. Ehlers, we are going to take another crack at that organic NOAA [National Oceanic and Atmospheric Administration] Act. You worked on that quite a bit and we will continue to work there.

And finally, we need to finish the work that this Committee has started. Last year, the Committee passed a total of 37 bills and resolutions of the House with strong bipartisan support. We are currently working with the Senate to speed up progress on 21 bills that are still waiting for action in that chamber. So this year poses a tall order for this Committee. However, I am optimistic that through our bipartisan approach we will be able to produce good legislation for the American people, and I look forward to continuing good counsel with my friend, Ralph Hall, and the Republican Members of this Committee.

Now, thanks to our panelists for being here and for their patience as we took care of some quick housekeeping. Now we move on to the reason that we are here this morning, and that is the America COMPETES Act.

As you know, in 2005, I, along with former Chairman Sherry Boehlert, Senators Lamar Alexander and Jeff Bingaman, requested that the National Academies conduct a study to assess the state of the Nation's competitiveness, the science and technology infrastructure in the United States and how it would affect future U.S. prosperity. The result was "Rising Above the Gathering Storm." This report included a comprehensive set of recommendations to create jobs and further U.S. competitiveness in an increasingly global marketplace. The Committee used these recommendations to create

the America COMPETES Act, which was signed into law in August of 2007.

The bill also established an Advanced Research Project Agency for Energy, better known as ARPA-E. This federal agency has already awarded its first round of \$4 million to \$5 million grants to researchers who are conducting high-risk, high-reward research in the energy field.

The funding process amazed everyone involved. They received a shocking 3,700 initial concept papers, asked 344 of those to submit full proposals, and eventually selected 37 proposals for first-round funding. The speed with which this agency was organized and processed these applications seemed unprecedented in the Federal Government. This efficiency is a direct result of the countless hours spent by ARPA-E Director Arun Majumdar and his dedicated staff working to achieve the agency's mission. Last month, ARPA-E announced that it is accepting applications for a second round of funding, which will soon go out.

But federal funding can only go so far. Many of the finalists have projects that are certainly just as deserving for grant funding as the award winners. That is why I suggested to Secretary Chu that he set up or create a fair in which these finalists could display their ideas and meet with potential investors. They agreed, and the first ARPA-E Innovation Summit will be held March 1st through 3rd at the Gaylord Convention Center in nearby National Harbor, and we are going to be looking for additional ways to try to bring in private-sector dollars for these good proposals as well as finding ways to try to get them to market as quickly as possible.

Now, this morning, however, we are here to discuss the need to reauthorize the America COMPETES Act, which expires at the end of the current fiscal year. We learned from the Gathering Storm, in order to create a sustained, well-educated workforce for an innovative economy, we need to establish sustained funding streams for these programs. Our witnesses this morning will help us to better understand how critical this Committee's commitment is to our prosperity and to our economic growth. I look forward to hearing from them about how COMPETES has affected or will affect U.S. innovation in the workforce and how these programs will help them sustain a skilled workforce in the future.

Chairman GORDON. Now I would like to I yield to my friend from Texas, Mr. Hall.

[The prepared statement of Chairman Gordon follows:]

PREPARED STATEMENT OF CHAIRMAN BART GORDON

Good morning. Before we start our hearing, I want to quickly talk about the Committee's agenda for this year. Members have a draft agenda at their desk. Much of it reflects what we have already discussed, and I welcome your further thoughts.

This morning, we are kicking off one of most important efforts of the year—to reauthorize our committee's landmark legislation, the America COMPETES Act.

We will also reauthorize NASA this year—setting it on a path for the next 10 to 20 years.

Among our initiatives, I also expect the Committee to take a closer look at advancing several energy technologies including those associated with nuclear energy, carbon capture and sequestration, marine and hydrokinetic energy, as well as energy efficiency and conservation technologies. These technologies not only have the potential to help curb climate change, they are also poised to create new industries and the jobs that go along with them.

Finally, we need to finish the work that we started last year. This Committee passed a total of 37 bills and resolutions out of the House with strong bipartisan support. We are currently working with the Senate to speed up progress on the 21 bills that are still waiting for action in that chamber.

So, this year poses a tall order for this Committee, however I am optimistic that through our bipartisan approach we will be able to produce good legislation for the American people. I look forward to continued good counsel with my friend, Ralph Hall, and the Republican members during this next year.

Thanks to our panelists for being here and for their patience as we took care of some quick housekeeping. Now, we'll move on to the reason we're all here this morning—the America COMPETES Act.

As you all know, in 2005 I, along with our former Chairman Sherry Boehlert and Senators Lamar Alexander and Jeff Bingaman, requested that the National Academies conduct a study to assess the state of our nation's competitiveness, the science and technology infrastructure in the United States and how it would affect future U.S. prosperity. The result was *Rising Above the Gathering Storm*.

This report included a comprehensive set of recommendations to create jobs and further U.S. competitiveness in an increasingly global marketplace. The Committee used these recommendations to create the America COMPETES Act which was signed into law in August 2007.

COMPETES authorized a total of \$33.6 billion over fiscal years 2008–2010 for science, technology, engineering and math education programs across the Federal Government. The bill also authorized multiple grant programs to help educate current and future teachers in the areas of science and math education, as well as invested in support for young researchers by expanding early career grant programs.

And, the bill also established the Advanced Research Projects Agency for Energy, better known as ARPA-E. This Federal agency has already awarded its first round of \$4 to 5 million grants to researchers who are conducting high-risk, high-reward research in the energy field.

The funding process amazed everybody involved—they received a shocking 3,700 concept papers, asked 334 of those to submit full proposals, and eventually selected 37 proposals for funding.

The speed with which this agency was organized and processed these applications seems unprecedented in the Federal Government. This efficiency is a direct result of the countless hours spent by ARPA-E director, Arun Majumdar and his dedicated staff working to achieve the agency's mission.

Last month, the ARPA-E announced that it is accepting applications for the second round of funding, and expect to announce those winners "soon." With this track record, I would not be surprised if "soon" means some time this Spring.

But, Federal funding can only go so far. Many of the finalists have projects that are certainly just as deserving of grant funding as the award winners. That's why I suggested to Secretary Chu and Director Majumdar that they create a fair in which those finalists could display their ideas and meet with potential investors. They agreed, and the first ARPA-E Innovation Summit will be held March 1st–3rd at the Gaylord Convention Center at nearby National Harbor in Maryland.

This morning, however, we are discussing the need to reauthorize the America COMPETES Act which expires at the end of the current fiscal year. As we learned from *Gathering Storm*, in order to create a sustained, well-educated workforce for an innovative economy, we need to establish sustained funding streams for these programs.

Our witnesses this morning will help us better understand how critical this commitment is to our prosperity and our economic growth. I look forward to hearing from them about how COMPETES has affected or will affect U.S. innovation and the workforce, and how these programs will help them sustain a skilled workforce in the future.

Mr. HALL. Mr. Chairman, thank you, and what a panel. Thank you very much, all of you, for your very valuable time.

You know, it has been nearly three years since we sat in this room with Norm Augustine and officially kicked off what was to become the America COMPETES Act. As everyone here is aware, America COMPETES was the culmination of recommendations from the off-quoted Gathering Storm report, former President Bush's American Competitiveness Initiative and efforts begun by this Committee under Republican leadership and continued very well by this chairman, one of the great chairmen in the history of

this committee. We all worked in a bipartisan fashion to get to where we are today with this measure, and I am very proud of our accomplishments.

My message hasn't changed much since then. If America is going to remain on top of the evolving world economy, we have to be dedicated to encouraging innovation and entrepreneurship while simultaneously cultivating the scientifically and technologically astute future workforce. While my message hasn't changed, unfortunately, our economy has.

America COMPETES was a step in the right direction to accomplish what was needed to be done. In H.R. 2272, we set out to double funding for the National Science Foundation, the National Institutes of Standards and Technology, and the DOE's Office of Science over a 10-year period. By the time we got through conference, this timetable was accelerated to seven years, plus these agencies received enormous amounts of stimulus funding, results of which have yet to be seen. That goes for COMPETES and for the stimulus funding.

Therefore, I am very much looking forward to the testimony of our very distinguished panel today because there is no doubt that we still have a lot to accomplish. At the same time, I would urge you, Chairman Gordon, to proceed cautiously through this reauthorization process as I believe it is prudent for us to ensure that we are reaping the benefits of the numerous initiatives already set forth in America COMPETES before creating others. Furthermore, and I hope our witnesses will attest to this today, COMPETES is just one aspect of improving America's competitiveness. President Bush once said, "The role of government is not to create wealth; the role of government is to create an environment in which the entrepreneur can flourish, in which minds can expand and which technologies can reach new frontiers," and I understand that that is in the Competitive Initiative today, that statement. Encouraging private-sector innovation through tax credits, a positive regulatory environment and other such programs will also improve the American economy, make us more competitive globally and bring new products and jobs to the American people.

I look forward to working closely again with you, Mr. Chairman, in this reauthorization and hear what our esteemed witnesses have to say.

With that, I yield back my time.

[The prepared statement of Mr. Hall follows:]

PREPARED STATEMENT OF REPRESENTATIVE RALPH M. HALL

Thank you, Mr. Chairman. It's been nearly three years since we sat in this room with Norm Augustine and "officially" kicked off what was to become the America COMPETES Act. As everyone here is aware, America COMPETES was the culmination of recommendations from the oft-quoted *Gathering Storm* report, former President Bush's American Competitiveness Initiative, and efforts begun by this Committee under Republican leadership and continued by you, Mr. Chairman. We all worked in a bipartisan fashion to get to where we are today with this measure, and I am proud of our accomplishments.

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America COMPETES was a step in the right direction to accomplish what needs to be done. In H.R. 2272, we set out to double funding for the National Science Foundation, the National Institute of Standards and Technology, and the DOE's Office of Science over a 10-year period. But by the time we got through Conference, this timetable was accelerated to seven years. Plus, these agencies received enormous amounts of stimulus funding, the results of which have yet to be seen. This goes for COMPETES and for the stimulus funding.

Therefore, I'm very much looking forward to the testimony of our distinguished panel today, because there is no doubt that we still have much to accomplish. At the same time, I would urge you, Chairman Gordon, to proceed cautiously through this reauthorization process, as I believe it is prudent for us to ensure that we are reaping the benefits of the numerous initiatives already set forth in America COMPETES before creating others. Furthermore, and I hope our witnesses will attest to this today, COMPETES is just one aspect of improving America's competitiveness.

President Bush once said, *"The role of government is not to create wealth; the role of our government is to create an environment in which the entrepreneur can flourish, in which minds can expand, in which technologies can reach new frontiers."*¹ Encouraging private sector innovation through tax credits, a positive regulatory environment, and other such programs will also improve the American economy, make us more competitive globally, and bring new products and jobs to the American people.

I look forward to working closely with you, Mr. Chairman, on this reauthorization and to hearing what our esteemed witnesses have to say on the subject.

[The prepared statement of Ms. Johnson follows:]

PREPARED STATEMENT OF REPRESENTATIVE EDDIE BERNICE JOHNSON

Thank you Mr. Chairman for holding today's hearing. I would like to thank today's witnesses for their commitment to increasing the competitiveness of our Country and sharing their perspectives on the need for innovation and STEM education.

In 2005, Members of this committee learned some startling facts from experts at the National Academy of Sciences "Gathering above the rising storm" report. We learned that children in other developed Nations may be better prepared for the jobs of the future than our own children here in the States. We learned from the experts that there are clear signs that the United States has begun to lose its status as a global economic and technological leader due to an inadequate investment to Research and Development and STEM development.

In response, I along with other Members of Congress, many on this committee today, worked to draft the America COMPETES Act in a bi-partisan fashion. This legislation represents a concerted effort to create a more competitive science and engineering workforce.

Today in 2010, as many components of the original COMPETES bill are just now taking effect, the need for the reauthorization of this act is now more pressing than ever. Our nation's students are still falling behind our international competitors due to a lack of commitment. We have allowed ourselves to fall behind because we are not consistently investing in our future. The time to act is now.

In order to achieve these goals, I have always fought to make sure we legislate effectively in an equitable fashion.

Socioeconomic stature, race, or gender should not stand in the way of a child's career. I fought for the America COMPETES Act to include special provisions to include and encourage women and under-represented minorities to pursue science and technology careers. As minorities and women continue to be under-represented in most STEM fields, we must do more to create opportunities to educate and retain them, especially at the university faculty level.

Year after year, my colleagues on this committee as well as those on the Congressional Black Caucus, Diversity and Innovation Caucus and others fight to urge support for programs that broaden participation in science, technology, engineering and mathematics: also called STEM.

A few weeks ago, I attended the President's "Educate to Innovate" kickoff event at the White House. One of the goals of this campaign is to expand STEM education and career opportunities for under-represented groups, including women and girls. I am pleased the administration is stepping forward to address these challenges.

The United States is slipping in STEM competitiveness worldwide, and it is a matter of our international standing in the world, and national security that we maintain adequate funding for science and technology education. Our country bene-

¹—President George W. Bush, May 2001.

fits the most if we ensure all Americans have the skills necessary to compete in the 21st Century.

I would like to commend today's panelists for their hard work. It is consistent commitment like yours that will help create new jobs, invoke new innovation, and prepare a strong, diverse STEM workforce for our future.

Chairman GORDON. Thank you, Mr. Hall, and you can be well assured that we are going to move with care as we reauthorize this. As Mr. Castellani and others have pointed out in their written testimony, there does need to be reviews, evaluations and accountability for COMPETES, and within the original bill there were a number of reports that were required to be submitted to us concerning accountability. The first one has come in and the others will be coming in as we go through this authorization.

I also concur with you, and this is a very distinguished panel. We have been fortunate to have Bill Gates, the Speaker, many Nobel laureates speak before us, but no panel has been more distinguished than this panel, and I say that sincerely and we welcome you.

Now it is my pleasure to briefly introduce you so we can get on with business.

Mr. HALL. Mr. Chairman?

Chairman GORDON. Yes, sir.

Mr. HALL. First, can I tell you, I couldn't help but ask Bill Gates for some money. I asked him for \$300. He said he hasn't had that little amount of money in his pocket since he was 12.

Chairman GORDON. It is my pleasure to first introduce Mr. John Castellani. He is the President of the Business Roundtable, an association of chief executive officers of leading U.S. corporations. These corporations represent a combined workforce of nearly 12 million employees. Second, Mr. Tom Donohue is the President and CEO of the U.S. Chamber of Commerce. Since assuming the role in 1997, Mr. Donohue has helped the Chamber grow to represent more than three million businesses, nearly 3,000 state and local chambers, 830 associations and over 90 America Chambers of Commerce abroad. Governor John Engler is President and CEO of the National Association of Manufacturers, the largest manufacturing industry trade group in America representing small and large manufacturers in every industrial sector in all 50 states. And Ms. Deborah Wince-Smith is President and CEO of the Council on Competitiveness, an association where CEOs, labor leaders and university presidents work together to ensure that the United States remains competitive in a global economy.

Your written testimony will be included in the record, and when you complete your testimony, we will then begin questions. Each Member will have five minutes to question the panel.

Mr. Castellani, please begin.

STATEMENT OF STATEMENTS OF MR. JOHN CASTELLANI, PRESIDENT, BUSINESS ROUNDTABLE

Mr. CASTELLANI. Thank you, Mr. Chairman, Ranking Member Hall, Members of the Committee.

As the Chairman said, the Business Roundtable is an association of chief executive officers. In addition to the 12 million employees that they represent, they also represent nearly \$6 trillion in annual revenue, and most relevant for this Committee, they spend more

than \$111 billion annually in research and development. That is nearly half of all of the total research and development, private research and development, in the United States.

I welcome the opportunity to appear before you today to address reauthorizing the America COMPETES Act, which Business Roundtable views as a fundamental prerequisite to restoring stable, long-term economic growth and job creation.

America's CEOs are committed to accelerating American innovation and boosting worldwide competitiveness of the United States. They understand that investments in science research and math and science education help create the platform for sustained long-term growth.

The formula is simple. Investments in research and education provide the tools for accelerated technological innovation, which drives productivity growth. Innovation leads to new products and processes and even whole new industries, generating high-wage employment and a higher standard of living for all Americans.

The Business Roundtable's commitment to fostering U.S. innovation and competitiveness is not new. In 2005, the Roundtable, together with other national business associations, including my friends on this panel, created Tapping America's Potential campaign, or TAP, with the goal of significantly increasing the number of American science, technology, engineering and mathematics graduates with bachelor's degrees. We believe that expanding the talent pool is a critical element, perhaps the critical element, of the innovation agenda that America must pursue to remain competitive in the 21st century.

When Congress passed the America COMPETES Act in 2007, the United States faced major competition from powerful new economic rivals. Some were minor competitors only a decade ago. Today, those rivals have emerged from the economic downturn in an even stronger position, and while the United States struggles with high unemployment and crippling budget deficits, China is pouring billions into research and education. Reauthorizing the Act and providing sustained support for its key provisions will help attract more young Americans into technical fields and expand American workers' employment horizons and earning potential.

The America COMPETES Act authorized significant increases in research investments that directly enhance America's ability to innovate and create new jobs. COMPETES also authorized scholarship and training programs to recruit high-performing K-12 math and science teachers to enhance the skills of existing teachers. The lack of qualified math and science teachers in American public schools are a major impediment to improved U.S. educational achievement in math and science. In many respects, the state of America's public education system is one of our Nation's greatest weaknesses. Nearly every job created in the United States over the next ten years will require more math and science fluency than the average job today. The question is, will America produce the skilled workers to fill these positions?

Last month, Business Roundtable released the final recommendations from The Springboard Project, which is an independent commission we convened to ensure that American workers thrive after the economy rebounds. The commission found that the

gap between worker skills and the needs of employers is widening, exactly the opposite of what we would hope to see if every American is to gain fulfilling employment. Strengthening STEM [Science, Technology, Engineering, and Mathematics] education at all levels needs focused attention now and in the future.

One of our greatest challenges going forward is securing stable funding commitments from Congress for the America COMPETES Act. It is our job to persuade you that nurturing America's innovation's ecosystem, even in the face of severe fiscal constraints, is necessary for the near term and for the long term.

The Business Roundtable is proud to have been an early supporter of the original America COMPETES Act, and we strongly support its reauthorization. With the right policy choices, we believe that America will recover from its current economic circumstances and provide prosperity and opportunity for all its citizens.

I want to thank you again, Mr. Chairman and Ranking Member Hall and the Members of the Committee. Mr. Chairman, under your leadership, this Committee has been a model for developing bipartisan solutions that address critical issues. We will miss that leadership. We look forward to the remainder of your term, and I would be delighted to answer your questions. Thank you.

[The prepared statement of Mr. Castellani follows:]

PREPARED STATEMENT OF JOHN CASTELLANI

Mr. Chairman, Ranking Member Hall, Members of the Committee, good morning. My name is John Castellani, and I serve as President of the Business Roundtable, an association of chief executive officers of leading U.S. companies with more than \$5 trillion in annual revenues and more than 12 million employees. Business Roundtable member companies are technology innovation leaders, with more than \$111 billion in annual research and development spending—nearly half of all total private R&D spending in the U.S.

I welcome the opportunity to appear before you today to address the vitally important task of reauthorizing the America COMPETES Act, which Business Roundtable views as a fundamental prerequisite to restoring stable, long-term U.S. economic growth and job creation.

America's CEOs are committed to accelerating American innovation and boosting the worldwide competitiveness of the United States. They understand that investments in scientific research and math and science education help create the platform for sustained, long-term growth.

The formula is simple. Investments in research and education provide the tools for accelerated technological innovation, which drives productivity growth. Innovation leads to new products and processes—even whole new industries—thereby generating high-wage employment and a higher standard of living for all Americans.

Business Roundtable's commitment to fostering U.S. innovation and competitiveness is not new. In 2005, the Roundtable, together with other national business associations, including those on this panel, created the Tapping America's Potential campaign, or TAP, with the goal of significantly increasing the number of American science, technology, engineering and mathematics graduates with bachelor's degrees. We believe that expanding the talent pool is a critical element—perhaps *the* critical element—of the innovation agenda that America must pursue in order to remain competitive in the 21st century. The America COMPETES Act is an important tool in achieving that goal.

When Congress passed the America COMPETES Act in 2007, the United States faced major competition from powerful new economic rivals, some of which were minor competitors only a decade ago. Today, those rivals have emerged from the worldwide economic downturn in an even stronger position. While the United States struggles with persistent high unemployment and crippling budget deficits at every level of government, China continues to pour billions into research and education in a determined effort to move up the value chain and produce more high-value-added products and services. At a time when America's ability to finance critical invest-

ments in national innovation capacity is constrained, our global competitors are redoubling their efforts to challenge U.S. innovation leadership.

Mr. Chairman, as you know, after you and your colleagues on the Committee led Congress to pass the America COMPETES Act, it took nearly two years and the worst economic crisis since the Great Depression before the provisions of the Act were adequately funded. It is perhaps ironic that as Congress prepares to reauthorize the Act, its original enactment is just now beginning to be implemented and the programs have not yet been rigorously evaluated. Yet we can say with confidence that reauthorization of the America COMPETES Act is absolutely vital to ensuring future U.S. innovation leadership and prosperity and security for America's workers.

Reauthorization of the Act will provide support for the foundations of America's innovation system at a time when some question America's commitment to continued worldwide technological and economic leadership. Reauthorizing the Act and building on its key provisions will help restore confidence in America's future, attract more young Americans into technical fields, and expand the employment horizons and earnings potential of millions of new American workers.

The America COMPETES Act authorized significant increases in physical science and engineering research sponsored by key civilian science agencies, research that directly enhances America's ability to innovate and create new jobs. These research investments will also help America address its energy and sustainability challenges. In June of last year, Business Roundtable released a major economic study, *The Balancing Act: Climate Change, Energy Security and the U.S. Economy*, which outlined six key technology investment pathways that can lead to efficient greenhouse gas reductions without harming long-term economic growth. Extending the authorized increases for physical sciences and engineering research will provide the knowledge creation necessary to accelerate development of the advanced energy technologies recommended in Business Roundtable's report.

Mr. Chairman, you and your colleagues on this Committee have led Congress in adopting a farsighted approach to energy technology development that focuses on a balanced, portfolio of research investments that will yield dramatic gains in energy efficiency, renewable energy technology, carbon capture and storage for coal-fired power plants, advanced nuclear energy technology, and smart grid and transmission technologies that will enable greater use of electric vehicles and renewable power. The fact is that we will need every one these new technologies to address climate change and power our economy. Technology is not a silver bullet, but it does offer a critical advantage in smoothing the transition to more sustainable economic growth, greater energy security and a cleaner environment. This is a clear case of science in service of national need. Reauthorizing the America COMPETES Act is an essential component of our national effort to address America's energy and sustainability challenges.

The America COMPETES Act authorized new and expanded scholarship and training programs to recruit new K-12 math and science teachers and enhance the skills of existing teachers. Business Roundtable has identified the lack of qualified math and science teachers in America's public schools as a major impediment to improved U.S. educational achievement in math and science. In 2008, Business Roundtable and our partners released the TAP progress report, *Gaining Momentum, Losing Ground*, which documented how U.S. student achievement in math and science continues to fall short compared with students from our global economic competitors—despite commitments from the White House and Congress to improve U.S. math and science education. When it comes to innovation, the state of America's public education system is our nation's greatest weakness. Extending the math and science education provisions of the America COMPETES Act and evaluating their effectiveness helps give America's children the preparation they need to succeed in the 21st century workplace.

Mr. Chairman, this is a critical issue for America and for this Committee. The persistent poor performance of U.S. students in math and science threatens our security and long-term prosperity. Over the past twenty years, occupations that require technical proficiency have grown nearly three times faster than the overall rate of employment growth. Workers in technical fields earn more and enjoy greater job security than most other workers. Technical professionals have weathered the economic downturn better than other workers, and there is some evidence that the technology-intensive industries that employ these workers are leading America's economic recovery. Nearly every job in America requires more math and science proficiency than those same jobs required twenty years ago. Nearly every job created in the United States over the next 10 years will require more math and science fluency than the average job today. Will America produce the skilled workers to fill these positions?

Last month, Business Roundtable released the final recommendations from The Springboard Project—an independent commission it convened—to ensure that American workers thrive after the economy rebounds. Based on surveys of workers and employers, the commission found that the gap between worker skills and the needs of employers is widening, exactly the opposite of what we would hope to see if every American is to find gainful, fulfilling employment. It will come as no surprise to you, Mr. Chairman, that the commission found that improving education and training in the United States is essential to building a more highly skilled workforce. The need is pressing. Seventy-three percent of the U.S. Bureau of Labor Statistics' projected fastest growing occupations require some level of postsecondary credentials, yet the United States ranks second-to-last among developed countries in postsecondary completion rates.

As you and your colleagues examine the America COMPETES Act, the math and science education provisions of the Act have the potential to offer the most promise for beneficial results for the American people. Strengthening K–12 math and science teacher recruitment and training, expanding proven math and science education programs, and supporting math and science education in the nation's community colleges provide the foundation to advance overall U.S. competitiveness and the individual economic success of Americans. It also is critical for you to coordinate closely with the Education and Labor Committee during the reauthorization of the Elementary and Secondary Education Act in order to ensure a coherent strategy to improve science, technology, engineering and math education.

One of our greatest challenges going forward, Mr. Chairman, is one that you are intimately familiar with and that is securing stable funding commitments from Congress for the programs authorized by the America COMPETES Act. Our nation's science and technology enterprise is a miraculous font of knowledge and wealth creation. The technology that has flowed out of this enterprise over the last century has transformed our lives, created an ever-rising standard of living for all Americans, and unleashed an astonishing wave of productivity and economic growth. The economic data are clear. Investments in research and education are among the most productive investments available to Federal policy makers. It is our job to help persuade Congress that nurturing America's innovation ecosystem, even in the face of severe fiscal constraints, is the right policy choice for the near term and the long term. Our future depends on it.

Business Roundtable is proud to have been an early and robust supporter of the original America COMPETES Act, and we strongly support its reauthorization. It embodies a sound, positive agenda for growth that will help lift America out of the economic doldrums and open up new opportunities for U.S. workers.

Mr. Chairman, it is up to us to ensure that America remains the world's technological and economic leader for the remainder of this century. With your help, and the help of all of the Members of the Committee on Science and Technology, Business Roundtable believes that America will recover from its current economic circumstances and continue to lead the world in providing prosperity and opportunity for its citizens.

Thank you again Mr. Chairman, Ranking Member Hall, and Members of the Committee. Under your leadership, Mr. Chairman, this Committee is a model for developing bipartisan solutions that address critical issues. I appreciate this opportunity to express Business Roundtable's views on this important legislation. I welcome your questions.

BIOGRAPHY FOR JOHN CASTELLANI

John J. Castellani is President of Business Roundtable, an association of chief executive officers of leading U.S. corporations with a combined workforce of nearly 10 million employees and \$5 trillion in annual revenues. Business Roundtable has been cited by the Financial Times as "the most influential chief executive lobbying group in the U.S." and is at the forefront of public policy debates, advocating for a vigorous, dynamic global economy.

Business Roundtable companies give more than \$7 billion a year in combined charitable contributions, representing nearly 60 percent of total corporate giving. They are technology innovation leaders, with more than \$70 billion in annual research and development spending—more than a third of the total private R&D spending in the U.S.

Since joining Business Roundtable in May 2001, Castellani has significantly strengthened the Roundtable's reputation in Washington, DC, nationally and internationally and has led the Roundtable's efforts on key public policy issues ranging from trade expansion to civil justice reform to fiscal policy. He has been cited by Bloomberg as one of Washington's six most influential lobbyists.

Castellani and the Roundtable played vital roles in the adoption of long-awaited civil justice reform legislation in 2005, approval of the Central America Free Trade Agreement, and enactment of critically important legislation to lower tax rates and slash taxes on dividends in 2003. He also has been a leader of the coalition working in support of Social Security reform. Other significant areas of leadership for Castellani and the Roundtable include passage of bilateral free trade agreements with partners including Australia, Chile and Morocco; passage of the SarbanesOxley corporate governance reforms; organizing the Partnership for Disaster Response to improve the flow of private sector resources, services and staff following a major disaster; and development of the Business Roundtable Institute for Corporate Ethics, a first-of-its-kind business ethics center designed to renew and enhance the link between ethical behavior and business practices.

Castellani is called frequently by the news media for comment on business and public policy issues, and has appeared on such programs as NBC's "Meet the Press," PBS' "The NewsHour with Jim Lehrer," Fox News Channel's "Special Report," and CNBC's "Street Signs." He regularly provides testimony before Congress on issues of key concern to Business Roundtable, and has discussed the Roundtable's agenda for economic growth in speeches to the Detroit Economic Club and the National Conference of State Legislatures.

Prior to becoming President of Business Roundtable, Castellani was Executive Vice President of Tenneco Inc., and part of the senior management team that led the transformation of the ailing conglomerate into seven strong companies.

Castellani's Washington experience includes serving as Vice President for Resources and Technology with the National Association of Manufacturers, and as Vice President of State, Federal and International Government Relations for TRW Inc. He started his career at General Electric as an environmental scientist and strategic planner.

In 2007, Castellani was named one of the 100 most influential people in corporate governance by *Directorship Magazine*.

A graduate of Union College (Schenectady, New York), Castellani now serves on its board of trustees. He is also an Ethics Resource Center Executive Fellow and a member of the Advisory Council of the Business Roundtable Institute for Corporate Ethics in addition to being a member of The Economic Club of Washington, D.C. He and his wife, Terry, reside in Washington, DC, and have two sons.

Chairman GORDON. Mr. Donohue is recognized.

**STATEMENT OF MR. THOMAS J. DONOHUE, PRESIDENT AND
CEO, U.S. CHAMBER OF COMMERCE**

Mr. DONOHUE. Thank you very much, Mr. Chairman, Ranking Member Hall and Members of the Committee.

As the Chairman indicated, the Chamber is the world's largest business federation representing companies of every type. My colleagues here have special relationships with many of those companies and we all are going to testify today in a way that you will probably find a lot of common spirit and common thought in our remarks.

In the wake of the worst economic crisis since the Great Depression, our Nation is engaged in a vigorous debate on how to create jobs, how to force long-term growth and how to enhance our global competitiveness. There are many different voices and viewpoints and plans but almost everyone agrees on one thing: the fate of our economy, the hopes of our children and the viability of the American dream begin and end with education.

There was a time not long ago when America was the unquestioned leader in education. We led in math and science. We led in the number of post-graduate degrees. Our K-12 system was the envy of the world. Our research fueled tremendous new discoveries in every field. Those days are gone. The rest of the world is catching up and we are running in place or falling behind in some places.

Our education system still has many great strengths. We have the best universities and research facilities in the world. We have many outstanding teachers. We have ambitious students eager to learn and to realize their potential, but it is not good enough. Our Nation can't do well by simply doing okay.

The statistics tell a very alarming tale. High school dropout rates are approaching 30 percent for all students and nearly 50 percent for minorities. American 15-year-olds rank 21st out of 30 in science literacy among their peers from developed countries and 25th out of 30 in math literacy. More than half of the U.S. science and engineering postdoctoral students in the United States are on temporary visas from other countries, and even though IBM topped the 2009 list of new patent awards, only four U.S. companies were in the top 10. So we can't continue this way and expect to compete and win in the worldwide economy. We can't continue this way if we hope to lead the world in science, technology, engineering and math, and we can't continue this way if we hope to provide better opportunities and a higher standard of living for our children and our grandchildren. That is why the U.S. Chamber and the business community it represents strongly supports the reauthorization of the COMPETES Act.

This legislation is moving America in the right direction. It is improving the number and quality of STEM teachers, increasing support and access for STEM students, attracting underrepresented groups to STEM courses, supporting basic research, and establishing programs that will help create new forms of energy and commercialize these innovations. The COMPETES Act puts the focus right where it should be, on increasing the number of American students proficient in STEM and ensuring that we have sufficient R&D funding to drive innovation and to propel technological progress. When it comes to research and development, the Chamber also strongly supports the permanent extension of the R&D tax credit. It will encourage needed investments in important areas of the economy such as renewable energy, energy efficiencies technologies, health care and biotechnology. Taken together, these initiatives can move us in the right direction, and I encourage you to move aggressively on it.

Mr. Chairman, with your permission, there is another area that I would like to just mention. I spent a good deal of time this morning at Walter Reed with the wounded veterans. We had a big job fair out there, and there are thousands of these people coming out of the military both wounded and otherwise who need our support, and the STEM program can go a long way to do that. One of the points that I would like to suggest is that many of these veterans are certified in important skills, and I hope that the Committee working with the government will look at how that certification can be done in a way that it is accepted in the private sector when they leave the military. Clearly it would help us recruit and it would help us place our veterans who need our support.

So, Mr. Chairman, the time runs short but I want to suggest that we move forward, and when you do so you vigorously evaluate the Act's progress as Mr. Hall suggested so that we do the right thing, get the major bang for the buck, be vigilant about duplicating of funding of efforts among different departments. I am more inter-

ested that they know what each other is doing, and encourage public-private partnerships. This is a very important thing that you have given much of your skill and energy and the Committee has as well, and we would do anything we can to help you complete this progress, complete this reauthorization and get it to work out in the real world, and I thank you very much for your time and I hope you will take a special look at the wounded veterans. They have earned our support.

[The prepared statement of Mr. Donohue follows:]

PREPARED STATEMENT OF THOMAS J. DONOHUE

Thank you Chairman Gordon, Ranking Member Hall, and members of the Committee, for inviting me to present this statement on the importance of a robust research and development program and rigorous Science, Technology, Engineering, and Math (STEM) education programs that will put the U.S. on course to maintain our ability to compete successfully in the global economy.

I commend Chairman Gordon and the Committee for your foresight in 2005. By joining Senator Lamar Alexander and Senator Jeff Bingaman in urging the National Academies to examine the top ten actions that Federal policymakers could take to enhance the science and technology enterprise, you brought this issue to the forefront of the national debate on American competitiveness.

Your efforts resulted in the 2005 groundbreaking report *Rising Above the Gathering Storm*. From this report, the American public learned that the Internet had not only brought the world closer together and created a global marketplace, but that “the Death of Distance” had created international competition for jobs.

In the early years of the information age, America led the way in global innovation. We believed that the education system we had and that the research and development investments we had made would keep us in the lead. But Mr. Chairman as you stated at the 50th anniversary of this committee in March of 2008, “I fear that our country has coasted on the investments we made 50 years ago.”

We are faced today with four challenges, a leaky pipeline for future talent; a lack of a national strategy for research and development; an aging workforce; and a set of national policies that need to be updated in order for America to regain its competitive edge.

At the heart of the knowledge economy is the notion that we can gather, manipulate, and convey information to create things and solve problems. There was a time when America topped the list for many key indicators such as: performance of students on international math and science exams, postsecondary degree attainment in the U.S. workforce, and number of patents awarded to U.S. companies. Today’s results on those same indicators reflect a nation that is falling behind. I have seen these numbers and the trends are moving in the wrong direction.

Our students’ results on national and international exams are especially troubling because they give us a glimpse of how deficient in STEM our future workforce will be. While we know that there are great schools, dedicated teachers, and high-achieving students across the country, we must recognize that our STEM performance has reached a plateau while other countries have improved dramatically.

High school dropout rates in the United States are approaching 30 percent for all students and nearly 50 percent for African-American and Hispanic students. Unfortunately, for those who make it to college, 35 percent will need remedial math in the first year, 23 percent for writing, and 20 percent for reading (NCES 2004).

On the 2009 Nation’s Report Card, also known as the National Assessment of Education Progress (NAEP), U.S. 4th graders who took the math test showed no improvement over previous years. Even more troubling, our 8th graders demonstrated only nominal gains after showing steady increases for years.

In the 2006 Programme for International Student Assessment (PISA) comparison, American 15-year-old students ranked 21st out of 30 in science literacy among their peers from developed countries, and 25th out of 30 in math literacy.

The OECD’s *Education at a Glance 2009* report, shows university-level graduation rates have virtually doubled from 18 percent in 1995 to 36 percent in 2007 in other OECD countries with available data. In contrast, the United States dropped from Rank 2 in 1995 to Rank 14 in 2007.

Our universities are preparing more graduate students from other nations than our own. Temporary visa holders accounted for 55% of U.S. science and engineering postdoctoral students in academic institutions in fall 2005.

The 2009 annual report by IFI Patent Intelligence, states that 51 percent of new patents issued by the U.S. Patent and Trademark Office were awarded to companies from outside the United States. While IBM was still number one with 4,186 patents, only four U.S. companies were in the top 10 down from five in 2008 and of the top 35, only 12 are U.S. companies.

I agree with President Obama that we must be makers of things and not just consumers of things. But in order for us to make things whether we are talking about nanotechnology, green energy, or life-saving medical devices, we must have people who possess the skills to do this work.

One challenge is that the American workforce is aging across all sectors. The Aerospace Industries Association reported in 2008 that Lockheed Martin conservatively estimates it will need to hire 140,000 people in the next 10 years, but that figure could be as high as 190,000 with half of that number being STEM professionals.

The aging of the baby boomer generation means a growing percentage of the industry's workforce will be eligible to retire in coming years. Nearly 6 percent of the R&D workforce retired in 2008, up from 2 percent the year before. Retirement eligibility remained roughly the same at 13 percent but is forecast to rise to more than 20 percent of the workforce by 2013. (Aviation Week)

The nature of work has evolved with the knowledge economy, and if America is to remain competitive, we must move from a model where only the elite STEM professionals are trained in these disciplines, to a model where all citizens have a common foundation in these subjects and are STEM-capable.

We must create a new definition of what it means to be a STEM professional. They are not just doctors, engineers, research scientists and information technology specialists. They are also electrical line workers, skilled technicians, and allied health professionals among others.

This means we must invest in an education system that will produce the workers we need, and invest in R&D so that our universities and private industry can continue to innovate.

The Carnegie Corporation of New York joined with the Institute for Advanced Study to create a STEM commission that released a report last year entitled the Opportunity Equation. The report emphasizes the importance of changing the way that math and science are taught. "Learning math and science from textbooks is not enough: students must also learn by struggling with real-world problems, theorizing possible answers, and testing solutions."

Through the Math and Science Partnerships at the Department of Education and the National Science Foundation, there is ample opportunity to improve teaching in math and science. We are encouraged that there are preliminary efforts to coordinate programs between the Department of Education and the National Science Foundation. Hopefully this will increase shared learning, provide a framework for evaluating programs, improve efforts to scale success throughout schools, districts and states, and reduce duplication of effort when possible.

The Institute for a Competitive Workforce (ICW) at the U.S. Chamber of Commerce is working with Carnegie and others to bring the business community together around these concepts. In November, ICW released the second report in its Leaders and Laggards series focused on education reform in America. We will encourage our members to support the policies and programs that will help to move the nation forward.

We must change the attitudes in this country about STEM and create a new paradigm where young people and adults understand the connection between STEM learning, career opportunities, and improving our society.

We applaud President Obama for advancing the development a national STEM agenda. The President and Secretary Duncan should be commended on their efforts to improve STEM learning by making it a priority in the Race to the Top competitive grant applications and through the Investing in Innovation Fund.

In November of 2009, President Obama launched the "Educate to Innovate" campaign which aims to increase STEM literacy so that all students can learn deeply and think critically in science, math, engineering, and technology; move American students from the middle of the pack to top in the next decade; and expand STEM education and career opportunities for underrepresented groups, including women and girls.

The business community firmly supports these goals and has pledged to engage its employees in state and local activities that support teaching and learning in STEM subjects. Several corporations have aligned their corporate philanthropy programs with these goals as a way to scale successful programs quickly. ExxonMobil supports the UTeach program and the National Math and Science Initiative. IBM's transition to teaching program directly addresses the STEM teacher shortage. The

Knoxville Chamber of Commerce has launched the Volunteers 4 STEM initiative that will pair 500 STEM teachers with professionals in relevant fields who can provide them with advice and support.

The America COMPETES Act of 2007 laid the foundation for a revitalization of a national STEM agenda. In conjunction with the American Recovery and Reinvestment Act, the COMPETES Act addresses the concern about public investments in STEM education, workforce development, and research.

In relation to Federal research and development much of the American COMPETES Act has yet to be implemented fully which makes it difficult to truly assess its impact to date. However, progress has been made and the incremental impacts have largely been positive. The creation of ARPA-E represents a bold step toward bypassing some of the traditional “stovepiping” that frequently hinders the efficiency and expediency of research and development at DOE and its National Laboratories. While implementation was initially slow, the \$400 million cash infusion from the Stimulus Bill has already led to significant movement. The projects that this program supports, ranging from advanced batteries to electricity generation, are projects that would probably not otherwise receive Federal funding because they are simply too risky. As the Congress recognized in creating ARPA-E, it is vital that we keep an eye well beyond the horizon and take chances on these high risk—high reward projects that might just change the entire landscape of how we produce and use our energy resources.

While several of the education programs that were authorized through America COMPETES have not been running long enough to evaluate how well they are working, we believe that the focus on improving the number and quality of STEM teachers; increasing support and access for STEM students at the postsecondary level; attracting underrepresented groups to STEM courses and careers; supporting basic research; and establishing programs that will help create new forms of energy and commercialize new innovations moves the right direction.

We encourage the committee to focus on evaluation as a priority when considering funding for new programs so that we can better understand where resources will do the most good. We also urge the committee to continue to be vigilant about duplication of funding and efforts among the Department of Education, the National Science Foundation, NASA, the Department of Energy and other Federal agencies. Coordination should be encouraged whenever possible to maximize the impact of government resources for individuals and for communities.

When possible, the committee should look at incentives that lead to public-private partnerships, the commercialization of new technologies, and regional STEM initiatives. These innovation ecosystems drive job creation, economic development, and regional stability that will contribute to regaining America’s lead in the global innovation market.

There are thousands of civilians and military personnel who have extensive STEM education and training. Unfortunately, the certifications that they have often do not translate from the military to the civilian, world or vice versa. The lack of reciprocity in certifications and licensure creates two problems, it discourages people from entering or leaving the military due to the need for retraining, and it wastes time and taxpayer dollars when people must be trained again to do something that they have already been certified to do. Inova Hospital in Virginia has created a joint program with the Army Reserve so that together they can recruit, train, credential, license and certify qualified Soldier candidates who are entering the health care field. I encourage the committee to find ways to replicate and scale programs like this one. We must find a way to make skills more transferable if we are going to expand and strengthen our workforce.

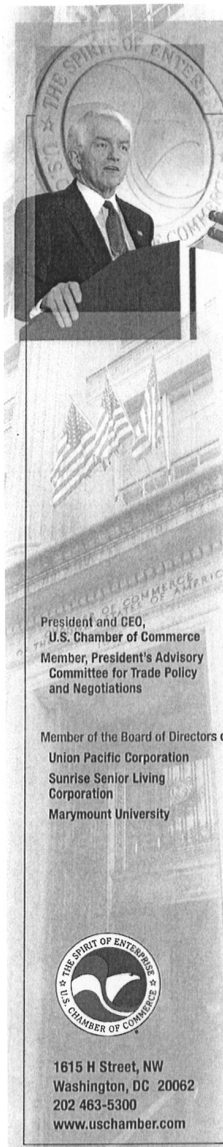
While I realize it’s not necessarily within the scope of the COMPETES Act or this Committee’s jurisdiction, but given the focus of this hearing on innovation and American competitiveness, I would be remiss if I didn’t note perhaps the single most important policy the Federal Government has for helping the private sector develop the products and ideas that will continue to keep the U.S. economy competitive for generations to come. The research and development (R&D) tax credit encourages businesses of all sizes to undertake cutting-edge research projects in the United States. Research and development is the very lifeblood of our knowledge economy. At a time when the American economy is weak, research and development across industry sectors makes it possible to create and maintain good, high-paying jobs at home and sharpens the ability of companies to compete in the global marketplace.

The Chamber has long supported the enactment of a permanent and stronger R&D tax credit. The Chamber believes the R&D credit spurs economic growth and encourages investments we need to make in important areas of the economy such as renewable energy and energy efficiency technologies, health care, biotechnology, manufacturing processes, and information and communications technologies. Mak-

ing this credit permanent would bring certainty which would encourage businesses to make long-term, high risk investments in the United States.

We commend the committee for its work on this issue and its dedication to ensuring that the America COMPETES Act achieves its purpose. Global competitiveness is a top priority for the business community and we will not be able to compete and win without strong national policies that support innovation.

BIOGRAPHY FOR THOMAS J. DONOHUE



Thomas J. Donohue

President and CEO, U.S. Chamber of Commerce

Thomas J. Donohue is president and CEO of the U.S. Chamber of Commerce. Since assuming his position in 1997, Donohue has built the Chamber into a \$200 million a year lobbying and political powerhouse with expanded influence across the globe.

Donohue has committed to advancing the U.S. Chamber's comprehensive competitiveness agenda, which is designed to strengthen the U.S. economy so that all hardworking Americans can prosper and enjoy the benefits of the American Dream. He has launched a number of multimillion-dollar initiatives around several items on that agenda, including forging a national energy strategy, strengthening capital markets, and protecting intellectual property.

Donohue established the U.S. Chamber Institute for Legal Reform, which has won significant legal reforms in the courts, at the state and federal levels, and in elections for state attorneys general and Supreme Court judges.

During Donohue's tenure, the Chamber's lobbyists, policy experts, and communicators have helped secure many legislative victories, including major tax cuts, more sensible workplace and environmental regulations, and increased funding for transportation. On the international front, the Chamber has become a leader in knocking down trade barriers, winning new free and fair trade agreements, and fighting isolationism at home and abroad.

Under Donohue's leadership, the Chamber has also emerged as a major player in election politics, helping elect congressional pro-business candidates through financial support and voter activism and turnout generated through the Chamber's grassroots organization, VoteForBusiness.com.

The National Chamber Litigation Center, the Chamber's law firm, has become more aggressive in challenging anti-business measures in court. In 2007, it entered a record 125 new cases of significance to the business community and helped secure 54 victories. The Litigation Center expects to beat that record in 2008.

The National Chamber Foundation, the Chamber's public policy think tank, drives the policy debate on key issues and provides a forum where leaders advance cutting-edge issues facing the U.S. business community.

Financially, the Chamber has never been stronger. Since 1997, when Donohue took over, revenues have more than tripled. Donohue has also raised millions of dollars for a special capital fund to help secure the Chamber's financial future.

Previously, Donohue served for 13 years as president and chief executive officer of the American Trucking Associations, the national organization of the trucking industry.

Donohue serves on two corporate boards of directors—Union Pacific Corporation and Sunrise Senior Living Corporation. He is a member of the President's Advisory Committee for Trade Policy and Negotiations. In addition, Donohue is president of the Center for International Private Enterprise, a program of the National Endowment for Democracy dedicated to the development of market-oriented institutions around the world.

Born in New York City in 1938, Donohue earned a bachelor's degree from St. John's University and a master's degree in business administration from Adelphi University. He holds honorary doctorate degrees from Adelphi, St. John's, and Marymount universities.

Donohue and his wife, Liz, live in Potomac, Maryland. They have three sons and three grandchildren.

The U.S. Chamber is the world's largest business federation representing more than 3 million businesses and organizations of every size, sector, and region.

Chairman GORDON. Thank you, Mr. Donohue.

Governor Engler, you are recognized, and we also recognize your time constraint at the end of the hearing too.

**STATEMENT OF GOVERNOR JOHN ENGLER, PRESIDENT AND
CEO, NATIONAL ASSOCIATION OF MANUFACTURERS**

Governor ENGLER. Thank you, Chairman, Ranking Member Hall, distinguished Committee Members. It is a pleasure to be here today and we appreciate the invitation to testify on behalf of the Nation's manufacturers on the America COMPETES Act. The National Association of Manufacturers [NAM] is the Nation's largest industry association representing manufacturers in all 50 states, every sector. We are also a very proud founding member of the Task Force on American Innovation formed to support basic research in the physical sciences and engineering, and I want to begin by thanking the Committee for championing the America COMPETES Act. I note behind you, "Where there is no vision, the people perish." Well, the bipartisan vision that led to this legislation and its enactment in 2007 and then the funding recently under the Recovery Act has really worked to fulfill some of the promise to the country, and I think this panel will be strongly in support of the issue of federal funding for basic research, and I certainly want to lend strong words of support as well, continued support. I point out, as John Castellani did, that research has long been a priority for the manufacturing sector in this country.

In December of 2005, the manufacturers joined the Department of Commerce in sponsoring a competitiveness summit that Deborah was very much a moving force in as well where basic research in that meeting was identified as a key contributor to economic growth and innovation, and so we certainly want to demonstrate broad support for programs we are addressing today. In the interests of time, let me focus on three other areas quickly: ARPA-E, the Advanced Research Projects Agency for Energy, STEM education, science, technology, engineering and math education, and the Hollings Manufacturer Extension Partnership, or the MEP.

First, ARPA-E. One of the most exciting elements of the America COMPETES Act was the establishment of ARPA-E. Manufacturers know you can't separate energy from the economy. ARPA-E supports research in both while also attempting to usher in new generations of clean, efficient sources of energy. The COMPETES Act calls for ARPA-E to accelerate transformational technological advances in the areas that industry by itself is not likely to undertake because of technical and financial uncertainty. ARPA-E's first funding opportunity released last May produced an outpouring of applications and award agreements are now being finalized, and the agency has also announced a second round totaling approximately \$100 million, and we want to work with the Committee certainly to evaluate the work of the agency as part of the preparation for this reauthorization so that ARPA-E can continue to encourage high-risk, high-reward projects and technological innovation, and I commend the Chair for the mention of the upcoming ARPA-E fair that is coming. It sounds like a very good idea.

Let me talk about STEM, preparing our next generation of manufacturers by improving education. Strong science, technology, engineering and math education is a foundation of a technical work-

force, helps students and workers prepare to develop the essential skills for a competitive manufacturing economy. However, the government's emphasis on STEM skills often begins and ends with the academic side of science and math. That is essential, of course, but the best R&D in the world can't go to market without the ability to produce the product. For manufacturers, the application of STEM skills for real-world workplaces is critical to developing this Nation's technical workforce. Programs outlined in the America COMPETES Act take a step toward this integration of skills needed by employers. We can move that integration to the next level through a series or a system of portable skills certification, not unlike what Mr. Donohue mentioned for our veterans coming back, recognize these portable skills certification by broad industry partners and implement it in high school and local two- and in some cases four-year colleges. The National Association of Manufacturers and our Manufacturing Institute have worked with key partners, world leaders in skills certification programs to develop a new system of credentials for students in postsecondary education, and Mr. Hall, the Bill and Melinda Gates Foundation, they did give us a couple of bucks, about a million and a half dollars, actually, of a grant to help bring this vision to reality. When the academic and technical programs are aligned with industry-recognized skill certifications, students can demonstrate and transfer their skills throughout the country and companies gain access to a richly enhanced pool of skilled workers. The recently introduced H.R. 4072, the AMERICA Works Act, sponsored by Congressman Minnick but also cosponsored by Congresswoman Dahlkemper of this very Committee, it elevates these programs such as these to proper standing and their educational priority. The NAM strongly supports this legislation.

Finally, just on MEP, I will close with that. High-tech manufacturing assistance to small manufacturers, we think it is a key program. It has received increased funding. The Hollings Manufacturing Extension Partnership, or MEP, as we all know it, is a network of not-for-profit centers that provides small and medium-sized manufacturers with expert advice on an array of business operations, and let me mention that a vast majority of American manufacturers are actually smaller companies, fewer than 500 employees. They account for something like two-thirds of manufacturing employment, and about half the value of all domestic production. In 2008, there were 59 of the NIST [National Institute of Standards and Technology] MEP centers serving nearly 32,000 manufacturers, helping them streamline plant operations, improve the bottom line, and that was opportunity then for growth in the market. In the previous years, just a couple of data points. The partnership contributed to more than 57,000 manufacturing jobs, helped deliver in excess of \$1.4 billion in cost savings and played a role in generating more than \$10.5 billion in sales. So we think that program pays a big dividend, a great ROI [Return on Investment] for our economy and helps the next generation of manufacturers.

So Members, we thank you very much for the opportunity to be here today. We strongly support the reauthorization of the America COMPETES Act. It is going to pay off for more jobs, more manufacturing and a more competitive U.S. economy.

[The prepared statement of Governor Engler follows:]

PREPARED STATEMENT OF GOVERNOR JOHN ENGLER

Introduction

Chairman Gordon, Ranking Member Hall, and distinguished members of the Committee: thank you for inviting me to testify on “America COMPETES: Big Picture Perspectives on the Need for Innovation, Investments in R&D and a Commitment to STEM Education.”

I am the President and CEO of the National Association of Manufacturers (NAM), the nation’s largest industrial trade association, representing small and large manufacturers in every industrial sector and in all 50 states. We are also a member of the Task Force on American Innovation,¹ whose mission it is to support basic research in the physical sciences and engineering. I am pleased to testify on behalf of our nation’s manufacturers and all those who wish to preserve our nation’s competitiveness and prosperity, on a critical issue—reauthorizing the America COMPETES Act.

I want to thank you, Mr. Chairman and Ranking Member Hall for championing and supporting the America COMPETES Act. Although the America COMPETES Act was signed in 2007, only recently did it achieve the funding necessary to fulfill its commitment to America.

I can tell you that the programs authorized in the America COMPETES Act are working to strengthen innovation in the U.S. manufacturing sector, and are helping us to build a stronger workforce. Today, I would like to highlight four programs that are of significant interest to America’s manufacturers. They are Federal funding for basic R&D; the Advanced Research Projects Administration for Energy (ARPA-E); science, technology, engineering and mathematics (STEM) education, and the Hollings Manufacturing Extension Partnership (MEP).

The Connection Between Federal R&D and Innovation in Manufacturing

Technology and the ability to translate innovation into products and services that meet the needs of businesses and consumers bolster the United States’ economy and our standard of living. Just as technology is key to strong economic growth and U.S. global competitiveness, manufacturing is key to technological advancement. No one sector has played a more important role in developing new technologies than manufacturers. Similarly, manufacturers lead the way in adopting new technologies to maximize efficiency and productivity.

Despite these advances, international competition continues to grow and America’s advantage in developing new technology can no longer be taken for granted. In order for the U.S. to maintain its competitive edge, it must promote forward-looking policies that encourage technology, and by extension, the U.S. economy. Our global competitiveness, in part, depends upon two important goals: encouraging growth in technology sectors that benefit U.S. manufacturers, and incentivizing manufacturers to further embrace advances in technology that will strengthen and secure the place of American manufacturers in the global economy.

The public sector plays a critical role in innovation. Over the past 60 years, government-funded research has contributed to major breakthroughs in science and technology. Through the Manhattan Project, we harnessed the atom; through NASA,² we unleashed space travel; through ARPA,³ we grew the Internet; and through SEMATECH,⁴ we shrunk the microchip.

Federally-funded R&D is what sets the United States apart from the rest of the world, but it is a distinction that we can lose. In 2008, the U.S. spent \$116.5 billion on federally funded R&D, facilities and fixed equipment—or 2.62% of its Gross Domestic Product (GDP).⁵ In the same period, China’s government invested \$52.4 billion in R&D (about 1.49% of GDP; up from \$29.4 billion in 2005). This does not include R&D expenses at labs owned by foreign companies. If China continues a ratio

¹<http://www.InnovationTaskForce.org/>

²National Aeronautics and Space Administration.

³Advanced Research Projects Agency was the forerunner of DARPA, the Defense Advanced Research Projects Agency, an agency of the United States Department of Defense responsible for the development of new technology for use by the military.

⁴SEMATECH (SEmiconductor MANufacturing TECHnology) is a non-profit consortium that performs basic research into semiconductor manufacturing, created to solve common manufacturing problems and regain competitiveness for the U.S. semiconductor industry that had been surpassed by Japanese industry in the mid-1980’s.

⁵Federal R&D Support Shows Little Change in 2008.” National Science Foundation, *Info Brief* September 2009.

of R&D spending of about 1.5% of GDP for 2009, its research will total about \$72 billion.⁶ However, China has one of the fastest-growing research budgets in the world, and by 2020 the government's goal is to invest 2.5% of GDP annually in research, which will cause China to rank third in the world in terms of total annual investment.⁷

In order to ensure that ground-breaking achievements continue, it is critical that policymakers both authorize and appropriate adequate funds for important government research agencies such as the National Science Foundation (NSF), the Department of Energy, the National Institute of Standards and Technology (KIST) and NASA. The America COMPETES Act put these key research agencies on a glide path to doubling their 2006-funding levels by 2016. The America COMPETES Act needs to be reauthorized to ensure that this goal does not fall to the wayside. As I mentioned earlier, only recently have sufficient funds been appropriated to fulfill our commitment to the COMPETES Act, funding that has come through the American Reinvestment and Recovery Act, the 2009 Omnibus Appropriations Act, and the pending passage of the FY '10 appropriations bills. We are greatly encouraged by the President's commitment to fulfilling the promise of the America COMPETES Act by his pledge to double the funding for these important research agencies through the President's Plan for Science and Innovation.⁸

The increase in NSF funding to \$7 billion in 2010, or 8.5 percent more than the 2009 enacted level, will support many more researchers, students, post-doctoral fellows and technicians contributing to the innovation enterprise. The 2010 DOE Office of Science Budget of \$4.9 billion, 3.5 percent more than the 2009 enacted level, will help us improve our understanding of climate science, continue the U.S. commitment to international science and energy experiments, and expand Federal support at the frontiers of energy research. And the 2010 Budget of \$652 million for NIST's intramural laboratories will improve NIST's research capabilities by providing high-performance laboratory research and facilities for a diverse portfolio of basic research in areas such as health information technology, the digital smart grid, and carbon measurements. Separately, the 2010 Budget also sustains NIST's external programs, including \$125 million in 2010 (a \$15 million increase over the 2009 enacted level) for the Hollings Manufacturing Extension Partnership (MEP) to enhance the competitiveness of the nation's manufacturers.⁹

Federal R&D Funding: Creating Jobs, Now and in the Future

The funds authorized by America COMPETES and released by the Recovery Act are going to help basic R&D create jobs in two ways: building infrastructure necessary to do cutting edge science, and funding grants that will help spur innovation. Infrastructure building includes completion of "bricks and mortar" projects at national laboratories, procurement of commodities for major Federally-funded research programs, purchases of modern scientific instrumentation associated with ongoing grants at universities and investments in both the scientific workforce and "green energy" initiatives. Short term, infrastructure building means that construction projects can begin in local areas, creating manufacturing and construction jobs and economic benefits now. Long term, the science done at these new facilities may bring about whole new industries, which will in turn create new jobs and economic benefits—as well as enhancing innovation, public safety and environmental protection—well into our future.

Economists can easily determine job creation numbers from physical infrastructure programs; determining job creation from federally funded R&D research projects is a bit more speculative. However, from these research projects industries are created, products are produced, Americans are employed, savings are realized, and our future is strengthened.

For instance, when the laser was first created using basic research from the Department of Defense, it was dubbed "a solution looking for a problem." However, through other federally sponsored research programs, applications were discovered and advances made; today, the laser is a critical component to the U.S. military, to health care, to consumer and business electronics, and especially to the manufacturing industry. It is just one example of how basic research—which may begin with no specific technology or product in mind—can lead to important discoveries, life-changing inventions, and economic growth.

⁶"Engineering & Research", Plunkett Research, website visited January 14, 2010.

⁷Ibid.

⁸See "The President's Plan for Science and Innovation, Doubling Funding for Key Basic Research Agencies in the 2010 Budget," Office of Science and Technology Policy, Executive Office of the President, May 7, 2009.

⁹Source: *Office of Management and Budget, Budget of the United States Government FY 2010*.

The benefits that can be reaped from federally funded research from the NSF, NIST and DOE Office of Science also produce ancillary benefits in areas that are critical to the American manufacturing sector, such as the economic health of the United States, health care, and energy consumption. Here are a few examples:

Economic Development: According to a joint analysis by the Commerce Department's Bureau of Economic Analysis and NSF, if R&D spending were treated as investment in the U.S. national income and product accounts, U.S. GDP would have been nearly 3 percent higher each year between 1959 and 2004. In 2004 alone, the U.S. GDP would have been \$284 billion more with the R&D satellite account.¹⁰

Health Care: The life expectancy of Americans rose from 47 to 78 between 1900 and 2009, largely due to advances gained from Federal biomedical research conducted with National Science Foundation, National Institute of Health, and Centers for Disease Control funding.

Energy Consumption: Buildings are the largest energy users in the United States. Federal research at agencies like the Department of Energy focused on emerging technologies for components, such as heating, cooling, ventilation, and refrigeration could lead to energy savings of 3.3 quadrillion BTU, or the equivalent to up to 200 million tons of coal.

Because of the America COMPETES Act, the Recovery Act and the 2009 Omnibus Appropriations bill, research grants are being awarded that will create jobs, foster innovation, and help revolutionize current industries and perhaps create new industries. Below is a sample of the dollar amounts of some of the grants that are now flowing into key research states.

Basic R&D Grants Awarded in 2009		
Key Research States	NSF Grants ¹¹	DoE Science Grants ¹²
California	\$123,408,737.00	\$2,047,728.00
Florida	\$20,566,109.00	\$861,016,154.00
Michigan	\$28,774,164.00	\$1,845,900.063.00
New Mexico	\$14,246,392.00	\$515,748,207.00
New York	\$70,452,823.00	\$1,484,014,258.00
Ohio	\$16,937,358.00	\$1,049,588,217.00
Pennsylvania	\$40,507,260.00	\$866,859,442.00
Tennessee	\$20,874,951.00	\$1,618,015,504.00
Texas	\$45,126,031.00	\$1,326,722,160.00
Wisconsin	\$9,546,100.00	\$623,992,686.00

ARPA-E and the Future of American Manufacturing

As this country and the manufacturing economy seek to remain competitive in an ever-evolving global marketplace, we must avail ourselves of every opportunity to drive economic growth, bolster our domestic energy resources and protect the environment. In order to secure these opportunities, significant and consistent investments must be made; we cannot let American ingenuity and innovation become a success story in other countries.

I commend the House Science Committee for recognizing the importance of supporting high-risk, high-reward projects by bringing the Advanced Research Projects Agency—Energy (ARPA-E) online. As the Director for ARPA-E, Arun Majumdar, notes in his open letter of December 15, 2009, the nation that successfully grows its economy with more efficient energy use, a clean domestic energy supply, and a smart energy infrastructure will lead the global economy of the 21st Century.¹³ ARPA-E is designed to ensure that the U.S. can do just that.

¹⁰ See "Toward Better Measurement of Innovation and Intangibles," BEA Briefing, Ana M. Aizeorbe, Carol E. Moylan, and Carol A. Robbins, January 2009.

¹¹ Source: National Science Foundation, January 14, 2009.

¹² Source: U.S. Department of Energy, January 14, 2009.

¹³ <http://arpa-e.energy.gov/public/dir-ltr.pdf>.

The NAM has long advocated that, in order to move this country forward, we need a fundamental transformation in how we produce, distribute, and consume energy. This transformation should start with a shift in how we view and approach energy research. While quality research is successfully conducted by U.S. manufacturers and the DOE, a new approach is needed that will expedite the development and deployment of technological innovations. This approach should leverage the vast intellectual capital throughout our country that we hope will lead to market success, the building of the necessary infrastructure and high paying jobs. This is the goal of ARPA- and it presents a unique platform to integrate innovative industry, research and development, and yield results.

The NAM was pleased to see that ARPA-E released its first funding opportunity announcement in May 2009. After the unprecedented response, award agreements are now being finalized. Additionally, ARPA-E has announced the launch of its second round of opportunities for a total of \$100 million. Knowing that demand for ARPA-E resources is so significant, the NAM looks forward to working with this Committee to ensure that the Agency is reauthorized and its funding remains at levels that will continue to support high-risk, high-reward projects and technological innovation.

The goals are simple—reduce our reliance on foreign sources of energy, improve the energy efficiency of all economic sectors, slow and reduce greenhouse gas emissions; and maintain US technological leadership in the world and in the development and deployment of energy technologies. Long term, this research will form the foundation of new R&D investments that meet the size and complexity of the challenges facing the energy sector.

Preparing our Next Generation Manufacturers by Improving Education

Strong Science, Technology, Engineering, and Math (STEM) education is the foundation for a technical workforce, and provides the fundamental skills necessary for a vibrant and competitive manufacturing economy. Improving the quality of K–12 STEM education and creating stronger educational pathways for graduate students in these fields, as supported in the America COMPETES Act, will provide employers with candidates that possess the necessary educational base to drive innovation in the manufacturing industry.

However, far too often our policies and investments related to the STEM skills begin and end with a focus on high science and math academic theory. For manufacturers, it is the application of science, technology, engineering, and math skills in real world workplaces that is critical to developing this nation's technical workforce and preparing an educated and skilled manufacturing workforce for the 21st Century.

It is in this area where we are experiencing a tangible skills gap. In a recent study by the Manufacturing Institute and Boston Consulting Group, over 1000 manufacturing executives identified a skilled educated workforce as the single most critical element of innovation success.¹⁴ In turn, they reported that innovation is the single most critical element of business success. So, if manufacturers require an educated and skilled workforce for business success, job creation, and the ability to compete in a global market, we must ensure we have the policies and investments in place to train our future workforce in critical STEM skills. The fundamentals developed with a strong STEM education program are not only for use as a pathway to advanced science research. No company can take R&D to market without the ability to produce the product. Strong STEM skills create a competitive business environment by contributing to skills on the production line as well as in the research lab.

As manufacturers, we take pride in measurable successes. Just-in-Time inventory management and Six Sigma process management defines how manufacturers look at business. It is therefore important to the manufacturing sector that modifications to the education system have quantifiable advantages. While many education and workforce reforms can take many years to have an impact, some reforms yield results much more quickly. For example, there is a direct statistical correlation between quality of workforce and innovation performance.¹⁵ Stated more directly, quality input means quality output. We need to ensure that we continue to train workers with the right skills to keep pace with the increasingly technical demands of the productivity-oriented manufacturing sector.

¹⁴ "The Innovation Imperative in Manufacturing," The Manufacturing Institute, Boston Consulting Group, 2009.

¹⁵ Ibid.

The P-16 program outlined in the America COMPETES Act takes a step toward integration of the skills needed by employers and education systems calling for education alignments with the private sector. Driving students toward advanced degrees in STEM areas is critical for competitive success; however, so is continuing the education for those who may not follow the traditional educational path. Preparing students and transitioning workers with applied STEM education to real world skills is just as important, and engages a sector of the workforce without a four-year college or graduate degree.

A portable skills certification system¹⁶ developed and recognized by broad industry partners, and implemented in high school and local two- and four-year college programs, moves the integration to the next level. When academic and technical programs are aligned with industry needs and standards, students gain recognized credentials and companies gain skilled workers. By creating more STEM pathways for secondary and post-secondary education, and aligning education with industry-recognized skills credentials, the United States can create the kind of manufacturing workforce that will facilitate ever-needed product and process innovations in an evolving global business climate. In fact, the recently introduced H.R. 4072, The America Works Act, sponsored by Rep. Minnick and co-sponsored by Rep. Dahlkemper who sits on this Committee, takes programs like these and prioritizes them within current educational programs.

The Hollings Manufacturing Extension Partnership: Bringing High-Tech to Small Manufacturers

Another key program in the America COMPETES Act that has received increased funding is the Hollings Manufacturing Extension Partnership (MEP). The MEP is a nationwide network of not-for-profit centers that provide small- and medium-sized manufacturers with services ranging from process improvements and worker training, to business practices and information technology.

Small manufacturing enterprises—defined by the Federal Government as companies with fewer than 500 employees—are critical to the U.S. manufacturing base as well as to the national economy. Over 99 percent of American manufacturers are smaller companies, and these manufacturers account for two-thirds of manufacturing employment and half of the value of all domestic production. Faced with steep downward cost pressures as a result of the global business environment, efficiency and innovation are critically important to these companies. The MEP provides small- and medium-sized manufacturers affordable access to technical expertise, so that they can create more high-paying manufacturing jobs—despite today's daunting economic cost pressures.

MEP's mission is to support, strengthen, and grow U.S. manufacturing. To do this, it provides customized and direct assistance to manufacturers through its nationwide network of MEP centers, with nearly 392 locations across the country, and more than 1600 field staff working every day with companies in their plants and offices. The nation's manufacturers, thanks to MEP assistance, have streamlined their plant operations and improved their bottomline—and as a result, have been able to create opportunities for growth via new sales, new markets, and new products. In 2008, MEP served 31,961 manufacturers.¹⁷

The impact of the MEP program on the U.S. economy is truly impressive. In FY 07 alone (from projects completed in 2007), the MEP helped to:

- create or retain more than 57,000 jobs;
- deliver \$1.44 billion in cost savings annually;
- generate more than \$10.5 billion in sales; and
- stimulate more than \$2.19 billion in economic growth.¹⁸

Thanks to the vision of this Committee, Congressional Leadership, and the Administration, the MEP program received increased funding this year, authorizing and appropriating \$122 million for its parent agency, the National Institute of Standards and Technology—Unfortunately, due to an uncertain economy, the future of this important program is in jeopardy. The NAM greatly supports the NIST MEP

¹⁶ Nationally portable, industry-recognized certifications validate that workers have the skill sets necessary to perform in a manufacturing environment and provide flexibility for the employee to take those skills anywhere in the marketplace, while also providing a streamlined hiring process for the employer.

¹⁷ Source: *NIST MEP Website*, January 14, 2009.

¹⁸ See *"Making a Difference for America's Manufacturers,"* NIST MEP Publication, February 11, 2009.

as it is a program that consistently reaps an enormous return on investment for our economy and fosters the next generation of American manufacturers.

Conclusion

Chairman Gordon, Ranking Member Hall, and other members of the Committee, thank you for the opportunity to testify today and represent our nation's manufacturing industries. We strongly support the reauthorization of the America COMPETES Act as the small investment in its critical components—doubling Federal R&D funding for the NSF, NIST and DOE Office of Science, reauthorizing ARPA-E, strengthening STEM education, and renewing our commitment to the Hollings Manufacturing Extension Partnership—will reap considerable returns by helping to create jobs today, and ensure our economic security in the future.

BIOGRAPHY FOR GOVERNOR JOHN ENGLER

John Engler is president and CEO of the National Association of Manufacturers (NAM), the largest industry trade group in America, representing small and large manufacturers in every industrial sector and in all 50 states.

Mr. Engler is a leading advocate for the 12 million American manufacturing workers. He promotes a broad-based agenda for maintaining U.S. competitiveness by lifting unnecessary burdens on manufacturing: excessive taxation and regulation, the high cost of health care, expensive litigation and soaring energy costs.

Recognizing that manufacturing provides the bulk of U.S. exports, Mr. Engler promotes opening foreign markets to this country's manufactured goods. He also has emerged as one of the nation's top advocates for developing the abundant domestic energy supplies in the U.S. He strongly supports expanding renewable energy and clean-coal technology and revitalizing America's nuclear power industry.

Mr. Engler sees the looming shortage of skilled manufacturing employees as a growing threat to American competitiveness in the 21st century's high-tech global economy. A former three-term governor of Michigan, he signed 32 tax cuts into law and helped create more than 800,000 new jobs during his tenure.

Prior to becoming Michigan's 46th governor in 1991, Mr. Engler served for 20 years in the Michigan legislature, including seven years as state Senate majority leader.

Chairman GORDON. Thank you, Governor.
Ms. Wince-Smith, you are up to bat.

STATEMENT OF MS. DEBORAH L. WINCE-SMITH, PRESIDENT AND CEO, COUNCIL ON COMPETITIVENESS

Ms. WINCE-SMITH. Chairman Gordon, Ranking Member Hall and distinguished Members of the Committee, thank you for the opportunity to provide testimony on the reauthorization of the America COMPETES Act. This landmark legislation was a turning point in the effort by government and private-sector leaders to refocus America's attention on the critical importance of innovation as the driver of economic growth. Your leadership and that of the Committee was crucial to its success. The Council fully supports its reauthorization.

Mr. Chairman, when the Council on Competitiveness was founded in 1986, our country was facing its most dire economic challenge since the end of World War II. Today we face new and grave challenges to our competitiveness. U.S. companies must retool their business strategies to remain competitive and the U.S. government must support policies to grow high-paying jobs here and investment. STEM education, investment in R&D and a skilled workforce are at the heart of that challenge.

The Council's 2004 National Innovation Initiative responded to these emerging challenges by bringing together more than 400 public and private-sector leaders to shape a national agenda to drive talent, investment and infrastructure and we were pleased to work

with our colleagues around this table. The Council strongly supported the America COMPETES Act as it mirrored many of these recommendations and it is also consistent with our next-generation initiatives in technology leadership, energy security and sustainability, and 21st century manufacturing.

Among those provisions that were included and should be included in future authorizations are strength in STEM education for all Americans irrespective of their future careers, steady and predictable increases in federal research funding for long-term basic research across all agencies, greater coordination across federal agencies for innovation policy and very important new models for public-private partnerships such as ARPA-E.

As the Committee looks to reauthorize the America COMPETES Act, let me emphasize that the importance of these provisions has increased, further compounded by the global economic crisis and the highest unemployment levels in America since the Great Depression. During these years, the world has not stood still. Global competition has accelerated, especially the rapid advancement of emerging economies all competing for high-value investment, manufacturing jobs and market success. In just one generation, emerging economies' shares of global imports, exports and foreign direct investment have nearly doubled. In a decade, China's R&D has grown from \$12 billion to \$102 billion, now placing China third in R&D spending behind only the United States and Japan, and China is now poised to surpass Japan as the world's second largest economy.

As companies have evolved from multinationals to global enterprises, they are building global talent networks for R&D for design, for manufacturing and service hubs to meet growing global consumer-driven demand. Additionally, the real-time global trade in tasks has also accelerated. Information, knowledge and technology are increasingly commodities, and the economic rewards are going to go to those nations who are prepared to invest in their people, take risks to develop and deploy products and services and create entirely new industries.

If we want to see investments, jobs, and growth in the United States, we must have a vibrant and diversified high-tech manufacturing sector. Our national security and competitiveness demand a strong industrial base. Under the leadership of our new chairman, Sam Allen, the CEO of John Deere and Company, the Council's Competitiveness Initiative is going to redefine the manufacturing enterprise as a value creation system, not just a product fabrication process. We will focus on productivity drivers and lifecycle cost structures to enable us to rise above the rising bar. We will benchmark the policy, regulatory and capital incentives our competitor nations are using to attract manufacturing investments at the forefront of science and technology ranging from the atomic world to large-scale extreme systems. We will also utilize our leadership technology initiative, bringing together the CTOs [Chief Technology Officer] across America's companies, led by the CTOs of Lockheed Martin and of General Electric, to create a roadmap for our science and technology leadership.

Clearly, energy and environmental issues and their impact on U.S. competitiveness in a low-carbon world are at the heart of

these challenges. Our new work, released in a recent summit, called “Drive” is really going to push a tremendous generation of innovation that will transform the world. We have to also ensure that we build on our strengths and use our innovation accelerators such as modeling, simulation and high-performance computing in which we still lead the world, to leapfrog our competitors.

Mr. Chairman, Ranking Member Hall and Members of the Committee, the America COMPETES Act was and is an urgent wakeup call for America. The need for Congressional bipartisan legislation and the involvement of all stakeholders in our society has not diminished. It has accelerated. The rest of the world is not waiting for us to act or to lead. We must act and lead. And Mr. Chairman, thank you for your tremendous leadership on this Committee and your service to our Nation. Thank you.

[The prepared statement of Ms. Wince-Smith follows:]

PREPARED STATEMENT OF DEBORAH L. WINCE-SMITH

Chairman Gordon, Ranking Member Hall and members of the Committee, thank you for the opportunity to provide testimony on the reauthorization of the America COMPETES Act. This landmark legislation signed into law in 2007 was a turning point in the effort by many people inside and outside of government to refocus America’s attention on the critical importance of innovation as the driver of economic growth. Your leadership and that of the Committee was crucial to the legislation’s success and I hope the effort to reauthorize the legislation will be similarly successful.

In my testimony today, I would like to share with the Committee a brief history of the impetus and outcome of the Council’s work on a national innovation agenda and how critical parts of this agenda related to the legislation passed in 2007. Then, I want to highlight some transformational changes in the national and global economy that have occurred in the past few years and how those shifts are impacting where and how innovations occurs; and, as a result, what issues this committee should consider as it seeks to reauthorize the America COMPETES Act.

THE COUNCIL ON COMPETITIVENESS AND THE NEED FOR AN INNOVATION AGENDA

The Council on Competitiveness is a non-partisan and non-governmental organization of CEOs, university presidents and labor leaders working to ensure U.S. prosperity. To achieve this mission we convene top private and public sector leaders to address America’s long-term, competitiveness challenges by generating innovative public policy solutions and galvanizing our unique coalition to translate ideas into action. We also seek to measure U.S. performance in the global marketplace to identify key obstacles and opportunities facing the nation.

The Council on Competitiveness was founded in 1986 during a time when the United States was facing its most dire economic challenges since the end of World War II. The country had slid from being the world’s largest creditor to its largest debtor, its position as a global leader in technology and innovation was being challenged and American industries were losing market share to international competitors. To meet these mounting challenges, two-dozen industrial, university and labor leaders joined together to found the Council, a forum for elevating national competitiveness to the forefront of national consciousness.

The 21st century poses new challenges to American competitiveness—globalization, high-speed communications, enterprise resilience and energy sustainability issues are forcing organizations at all levels to rethink how U.S. companies will remain competitive and how we will sustain and grow high paying jobs. After two decades, the Council on Competitiveness continues to set an action agenda to drive U.S. productivity and leadership in world markets and to raise the standard of living for all Americans.

The Council’s work on innovation dates back to the late-1990’s when we held a major innovation summit at MIT. This summit brought together private sector and government leaders to begin the conversation around where the United States stood with regard to its long term role as the world’s innovator. By 2003, it was clear that America could no longer assume that its past leadership in innovation would ensure its future prosperity. The world had changed.

- The United States was now competing and collaborating globally to attract the best and brightest minds to develop new knowledge and create the disruptive technologies that will launch new industries and products and create jobs.
- The United States was now competing and collaborating in a world in which the power of networked communications, the extended manufacturing enterprise and access to low-wage talent has enabled the outsourcing of both low and highskilled jobs.
- And the United States was now competing and collaborating in a post-Cold War security environment in which the United States must protect its citizens and homeland from threats from terrorist groups and rogue nations which have the technological means to wreak havoc on advanced economies.

The Council also recognized that the very nature of how innovation occurs, where it occurs and who the innovators are were changing as well.

- It was diffusing at ever-increasing rates. It took the radio 38 years to reach a market audience of 50 million people, but only 13 years for television, four years for the Internet, three years for the I-pod and one year for Facebook.
- It was multidisciplinary and technologically complex arising from the intersections of different fields or spheres of activity encompassing physical and biological sciences as well as social sciences and the humanities.
- It was becoming global in scope—with advances coming from centers of excellence around the world and driven by the demands of billions of new consumers.

What became clear as the Council prepared to launch its innovation initiative back in 2003 was that the innovation economy is fundamentally different from the industrial or even the information economy. It requires a new vision, new approaches and a new action agenda. The United States must create the conditions that will stimulate individuals and enterprises to innovate and take the lead in the next generation of knowledge creation, technologies, business models, dynamic management systems and high value job creation. A new relationship among companies, government, educators and workers is needed to ensure a 21st century innovation ecosystem that can successfully adapt and compete in the global economy.

NATIONAL INNOVATION INITIATIVE

This is why the Council launched the National Innovation Initiative (NII) under the leadership of Duane Ackerman, the CEO of BellSouth and Chairman of the Council from 2003–2005 and co-chaired by Sam Palrnisano the CEO of IBM, and Wayne Clough, the President of the Georgia Institute of Technology and now the Secretary of the Smithsonian Institution. We relied on the input of more than 400 public and private sector leaders including my colleagues testifying with me today and other leaders such as Norm Augustine, Craig Barrett, Chuck Vest and Bill Brody from the private sector as well as a bipartisan Honorary Committee of Members of Congress and Governors.

The 2005 NII report, *Innovate America* was downloaded more than 300,000 times and coupled with subsequent reports from the National Academies, the Business Roundtable, the National Governors Association and many others, helped build the momentum for congressional action on an innovation agenda for the country. It also created interest around the world with countries like China, Korea, Brazil and Turkey fashioning innovation agendas modeled on the NII.

Innovate America had three foundational platforms Talent, Investment and Infrastructure—the building blocks for an integrated, resilient innovation ecosystem and the subsequent legislation in many ways mirrored this structure.

In brief, *Innovate America* called for:

Talent

- Ensuring all Americans have the skills necessary to compete and prosper in the 21st Century with a strong emphasis on science, technology, engineering and math education (STEM).
- Increased support for multidisciplinary education and research.
- Attracting the best and brightest from around the world to study and work in the United States.

Investment

- Increased national investment in a balanced basic research portfolio.
- A focus on high risk/high reward research.

- A move toward regional economic development and a transition to an advanced manufacturing infrastructure.

Infrastructure

- Accelerating the deployment of 21st Century innovation infrastructures from broadband and high performance computing networks to a 21st Century patent system.
- A manufacturing infrastructure that will enable America to capture the economic value from our investments in research and our people.
- Tax incentives to encourage research and risk taking.

THE AMERICA COMPETES ACT

Needless to say, the Council strongly supported the America COMPETES Act as it mirrored many of the recommendations included in *Innovate America* as well as our 2006 *Competitiveness Index*. Among those provisions that were included and should be included in any future authorizations were strengthened STEM education for all Americans regardless of their career aspirations; steady and predictable increases in Federal research funding for long term basic research across all agencies; and greater coordination across Federal agencies and with the states on innovation policy.

Without going into great detail, I would like to highlight a few of the provisions from the 2007 legislation that I think remain critical and should be supported by the Members of the Committee.

1. The Council on Competitiveness strongly urged the creation of a President's Council on Innovation and the legislation included such a provision, yet the reality has not matched the intent. What became clear as we sought the input and advice from leaders within government and the private sector was that the government's innovation policy was fragmented, poorly coordinated and often running at cross purposes between agencies and departments. We would urge a fresh look at this provision.
2. Predictable and steady support for long-term research across Federal agencies including the National Science Foundation, DoE Office of Science, NIST and NASA is a vital first step toward an innovation-based economy. America COMPETES made great strides in this area. Any authorization should continue this commitment.
3. Support for the National Institutes of Standards and Technology's (NIST) work in the area of manufacturing is critical to many small and medium sized manufacturers. These companies are key job producers in America's economy. NIST has made strides toward embracing innovation in manufacturing and this trend is worthy of the Committee and Congress's support.
4. Strengthening STEM education through programs at the Department of Education, the National Science Foundation and other R&D agencies and departments is important. I realize there are multiple programs that touch upon this issue across the Federal Government and I will not try to analyze each one separately here. I only urge the Committee to recognize that almost every career today requires some grasp of or skill in science, technology, engineering and mathematics and we must ensure that all Americans have a solid grounding in these fields.

Before turning to where we go from here, I want to highlight a couple of items that were important parts of the Council's report, but were not included in the legislation. I recognize that not all of these issues fall under the Science Committee's jurisdiction, but any comprehensive innovation bill is going to touch multiple committee jurisdictions.

- Attracting the best and brightest from around the world to study, work and innovate in the United States would benefit our economy, but our high skilled immigration system continues to fail in this regard. This is a competitiveness issue as much as if not more than an immigration issue and should be addressed as such. A green card should be given to any foreigner who passes appropriate security screening and receives an advanced degree in science or engineering.
- *Innovate America* called for the creation of and support for regional innovation hot spots—locally developed and federally incentivized regions that bring together the public and private sectors to capitalize on local competitive as-

sets to create new jobs and new industries. The Administration is currently looking at ways to achieve this goal and those efforts should be supported.

- *Innovate America* also sought to focus attention on the importance of critical technologies and processes that need to remain viable in the United States if we are to generate value from our investments and continue to create jobs in the United States.
- *Innovate America* also identified over-the-horizon issues like energy security and sustainability that led to our recent Energy Security, Innovation and Sustainability initiative and summit last fall.

As the Committee looks to reauthorize the America COMPETES Act, I can only emphasize that the importance of these provisions has not waned with the passage of time and the deterioration of the global economy—they are critical to America's prosperity.

GLOBALIZATION CONTINUES TO CHANGE THE WORLD IN WHICH WE COMPETE

We knew the global economy was changing when the America COMPETES Act was first debated. Now, we know the global economy has fundamentally shifted. Global competition has accelerated—especially the rapid advancement of emerging economies:

- Because of their large and rapidly growing markets and relatively low wage labor, they are the favored location for foreign direct investment
- In just one generation, emerging economies' shares of global imports, global exports and foreign direct investment have nearly doubled
- And some are advancing rapidly as *R&D performing countries*. In about a decade, China's R&D grew from \$12 billion to \$86 billion. In 2008 China's R&D spending was \$102 billion, placing China in third place in R&D spending, behind only the United States and Japan. China is now poised to surpass Japan as the world's second largest economy.

The integrated global enterprise has developed rapidly. These enterprises use global networks for developing products and services, and for serving customers.

- For example, sales from foreign affiliates of U.S. companies are more than three *times greater* than U.S. exports of goods and services.
- These global enterprises are building global talent networks for innovation. And it is vital for regions to enter these networks.

Global trade in tasks has grown rapidly. If work is routine, rule-based, or if it can be digitized, there's a low cost source of labor somewhere in the world to compete for that work and those jobs.

Information, knowledge and technology are increasingly commodities. *And rewards do not necessarily go to those who have a great deal of these things, but to those nations who are prepared to create new industries and deploy new products and services.* Besides, many nations have rapidly built-up their own science and technology assets, so having those alone does not ensure success.

Instead, rewards go to those who know what to do with knowledge, information and technology once they get it. *This has created an innovation imperative for the United States that is, if anything, more urgent today than it was four years ago.*

BEYOND AMERICA COMPETES

America still has the best innovation system in the world, but if we want to see investments, jobs and growth in the United States, we need a vibrant and diversified manufacturing sector. Our national security, energy security and economic competitiveness demand it.

America lacks a strategy for manufacturing competitiveness. We need policies that make America a really attractive place to invest—a pro-innovation, pro-investment, pro-growth, pro-opportunity environment.

And that means we need to look at manufacturing as a value chain that spans ideas to delivered products, including cutting-edge science and technology, sustainable design and systems engineering, supply chain excellence and smart services—as well as lean and green production. The integration of these systems and services creates the value premium that captures global market share.

The Council is launching a major initiative in this area that will seek to:

- Redefine manufacturing as a value creation system, not product fabrication
- Focus on productivity drivers that enable us to rise above a rising bar

- Benchmark policy incentives and strategies competitor nations use to attract manufacturing investment
- Develop an integrated action agenda for 21st century competitive success.

A successful manufacturing strategy will exploit the leading edge of nanotechnology, biotechnology and digital technology. Advances in these fields will increase technological possibilities exponentially, unleashing a flood of innovation—creating new industries, companies, products, services and markets.

This ability to move quickly to deploy and capture value is a focus of the Council's Technology Leadership and Strategy Initiative, chaired by Dr. Ray Johnson, Senior Vice President and Chief Technology Officer for Lockheed Martin Corporation and Dr. Mark M. Little, Senior Vice President and Director of Global Research for the General Electric Company.

There is a great and growing need to solve global grand challenges—food and water shortages, pandemics, security threats, the needs of aging populations worldwide, climate change and meeting the global need for cheap, clean energy.

Energy and environmental challenges alone have created a perfect storm for energy innovation. As detailed in the Council's recent call to action on energy security, innovation and sustainability—**Drive**—energy and energy efficiency innovations are needed in transportation, appliances, green buildings, materials, fuels, power generation, industrial processes and more. I am pleased to enclose the full report for the Committee's review.

The environment for innovation is target rich, but we also need innovation accelerators. Modeling and simulation with high performance computing can be a force multiplier for innovation. These tools offer an extraordinary opportunity for U.S. manufacturers to design products and ancillary services:

- Faster
- To minimize the time to create and test prototypes
- To streamline production processes
- Lower the cost of innovation, and
- Develop high-value innovations that would otherwise be impossible.

Driving HPC, modeling and simulation throughout the supply chain would put these powerful tools into the hands of companies of all sizes, entrepreneurs, innovators and inventors to transform what they do.

CONCLUSION

Mr. Chairman, Ranking Member Hall and Members of the Committee, the America COMPETES Act was not a perfect bill, but it was an urgent wake up call. The bill included some provisions we did not recommend and left some out we felt were critical. Yet, there was no question of the need for action, by Congress. That need for action has not diminished and, if anything, the need is greater. Other countries are making investments in their science and technology infrastructure. They are educating and training their people. They are attracting investment and talent from around the world. To prosper, America must compete.

Thank you.

BIOGRAPHY FOR DEBORAH L. WINCE-SMITH



Deborah L. Wince-Smith is the president of the Council on Competitiveness, the only place where CEOs, university presidents, and labor leaders are working to ensure U.S. prosperity. Founded in 1986, this unique business-labor-academia coalition recommends actionable public policy solutions to make America more competitive in the global marketplace.

She is internationally renowned as a leading voice on competitiveness, innovation strategy, science and technology policy, energy, education, economics, and business.

As president of the Council, Ms. Wince-Smith spearheaded the groundbreaking National Innovation Initiative (NII), which played a pivotal role in creating a reinvigorated U.S. competitiveness movement. The NII shaped the bipartisan America COMPETES Act, created state and regional innovation initiatives, and brought a global focus to innovation.

Ms. Wince-Smith is a member of the Board of Directors of NASDAQ-OMX, Inc., and serves on the Audit, Compensation, and Finance Committees. She is also a Senate-confirmed member of the Oversight Board of the Internal Revenue Service, responsible for administering the Nation's tax laws, and the U.S. Department of State's Advisory Committee on International Economic Policy. She recently chaired the Secretary of Commerce's Advisory Committee on Strengthening America's Communities. She has served on four Cabinet-level advisory groups, including the Secretary of Energy's Task Forces on the Future of Science and Nuclear Energy.

Ms. Wince-Smith serves on the University of Chicago's Board of Governors for Argonne National Laboratory and was a long-standing member of the University of California President's Council on the National Laboratories, providing oversight for Los Alamos, Lawrence Livermore, and Lawrence Berkeley National Laboratories. Ms. Wince-Smith also serves on the Board of Directors at the Albert Shanker Institute.

During her 17-year tenure in the Federal government, Ms. Wince-Smith held leading positions in the areas of science, technology policy, and international economic affairs. Most notably, Ms. Wince-Smith served as the Nation's first Assistant Secretary of Commerce for Technology Policy in the Administration of George H.W. Bush, overseeing Federal Technology Transfer Policy, implementation of the Bayh-Dole Act, and the White House National Technology Initiative. She was also the first Assistant Director of International Affairs and Competitiveness in the White House Office of Science and Technology Policy and the architect of the landmark Head of Government Science and Technology Agreement with Japan.

Ms. Wince-Smith developed President Reagan's Competitiveness Initiative, and led the implementation of Executive Orders and new laws that transformed Federal technology transfer policy for U.S. national laboratories and American industry.

She began her career as a program director for the National Science Foundation, where she managed U.S. research programs with Eastern European countries and U.S. universities. Ms. Wince-Smith earned her B.A., magna cum laude, from Vassar College and her master's degree in classical archeology from King's College at the University of Cambridge. In 2006, she received an Honorary Doctor of Humanities degree from Michigan State University.

Chairman GORDON. Thank you. It is good to have a good committee to work with.

Mr. Donohue, you mentioned your time there at the military, or at Walter Reed this morning. Within the COMPETES bill, we set up a program where the National Science Foundation fast tracks STEM professionals into teaching, and I will talk with Chairman Skelton today about trying to partner with the DOD [Department of Defense], at least in that area. Hopefully we will be able to accomplish something. And you also mentioned, or cautioned, about duplication of programs. One of the themes of this Committee has been how do we stretch \$2 into \$3 rather than having to spend an extra dollar, and what we have tried to do is look at the various research programs within our jurisdiction and create an umbrella to coordinate that. We have done that in nanotechnology, in water research, and we are also now looking into the STEM areas, and we will continue to do that.

You also mentioned public-private partnerships, and I think what we have done here, again, is a theme in that much of our legislation when we set up research programs, we ask that there be a private-sector component or an advisory group set up to advise, not for all the research, but for a portion of the research, where should we be going with that? And I think today really is an example of a private-public relationship in that it was the public sector that asked the private sector, what do we need to do to make ourselves more competitive. You gave us recommendations. We put that into legislation. You helped us to pass it. And so what I would like to do now is really ask the panel what additional public-private partnerships might be necessary, and Mr. Donohue, I know that in a recent speech to the Chamber, you wanted to do 10 million jobs in 10 years, and is there a role there? I suspect that probably the whole panel would concur that less government is better but the question now, though, is there appropriate role for public-private partnerships? And I welcome your recommendations.

Mr. DONOHUE. Thank you, Mr. Chairman. We want to do 20 million jobs in 10 years.

Chairman GORDON. Oh, good.

Mr. DONOHUE. We need seven to replace the people that are out of work. We need 13 for all of those people who will be coming into the economy. And as was mentioned by a number of the speakers this morning, many of these jobs are going to be technologically based or far more technologically based than they were years before, and therefore the work that your Committee is leading here are preparing people for those jobs is critical. Our suggestion on how to drive those 20 million jobs we made in that speech is first of all expand our efforts because 95 percent of the people we want to sell things to live somewhere else, and we have the opportunity to do that right now, and if we would double it in five and double it again, you would create many of those jobs. And by the way, that is a public-private partnership because we need the help of the government to build the trade agreements and the trade arrangement that allow the private sector to compete against 150 other countries around the world that are trying to sell in and out of those markets.

The second thing we suggested and that I will focus on here for a minute is the issue of infrastructure. Now, we always think about infrastructure as roads and bridges and we have a highway bill for

that and we ought to hurry up and reauthorize it, but there is an extraordinary opportunity and a great deal of money waiting around for infrastructure issues on water, on questions of power generation, power lines, ports, railroads. Much of that money would come from the private sector. Had we not had this recession, it is my opinion we would have bumped up against the wall when we would have more business than we had infrastructure to support it, and I think you can find in those areas an extraordinary opportunity for public-private partnership both on the technological side, on the planning and development side, and particularly on the financing side, and I would call to your attention and keep you posted on the material that we are putting together on that. There are a whole series of other issues but I have already taken more time than you expected, and I thank you very much.

Chairman GORDON. Does anyone else want to comment there?

Governor ENGLER. Let me pick up on the STEM issue because I know that is of great concern to many Committee Members, and I think that is really obvious because it is the longest standing public-private partnership. Public education is part of the fabric of the Nation. I always say this when you ask me what should be done in public education: I have got a simple plan, that every child leave high school either prepared to go to college without needing remediation when they get there or prepared to go to the workforce with skills that have hopefully been measured and even certified, and the dropout rate has to be zero. That alone would of course transform the people coming into the workforce and would stretch \$2 into probably \$5. I am not sure. But I think the ability to link—and we have formed a first ever for us, a council of community college leaders to work with the manufacturers to talk about how we make this transition because there is, I think, for many people who don't know what they want to do, the need for them to become prepared. We have specific needs in manufacturing but there are other needs in other parts of the economy. Tom would have a lot of members that aren't our members that have maybe financial services needs or whatever but people need to be prepared, and we think that STEM education has a great value, and some of it is less traditional than the K-12 pre-college curriculum, and we think that there are programs, and I think if you look across America we have solved all of our education problems somewhere. We just are terrible at replicating it. And if we could simply replicate what works and if everybody used best practices that are available today, no new research, you would get a quantum improvement in STEM specifically, we think that the community college system and that integration has to go much further. I think some of the steps that you have laid out, some of the efforts that are underway are very powerful but we probably need to measure more and report more because we still have a problem. As Tom mentioned, there are a lot of people who are aging out of the workforce but they are aging out with 30 years of experience. The people who are coming in to replace them can't just walk in off the street and hope to do these jobs. They have to have preparation.

Chairman GORDON. Ms. Wince-Smith?

Ms. WINCE-SMITH. Well, I would just add and pick up on what Governor Engler just said about the material workforce. One of the

things that the Council is doing under our Tapping Mature Workers Initiative with Atlantic Philanthropy is to identify this tremendous pool of workers that have skills, and to work with them across communities as part of an innovation strategy to ensure that they can be redeployed into new occupations.

But I really wanted to mention the R&D partnership model and the importance of bringing the power of modeling, simulation and supercomputing down into the hands of our entrepreneurs and throughout the supply chain. This is something where the data and the productivity gains are huge, and if we can get this tool to do advanced design and prototyping, moving beyond traditional ways products are designed and deployed, I think it will have a tremendous impact. Excitingly, the capability for this exists in our national labs, it exists in our universities, and we have leading companies that are working with the Council to really spur this partnership along. It is also something that will be embedded into the new ARPA-E programs as well. So that is one in particular I want to highlight as very strategic for the future.

Chairman GORDON. Mr. Castellani?

Mr. CASTELLANI. Briefly, Mr. Chairman, let me suggest three areas. One, to reiterate what John Engler said, the private sector spends, we have added it up sometimes, somewhere between \$800 million and \$900 million a year trying to support education improvement, and learning from our mistakes, learning from what has worked I think is very important to avoid replication of those mistakes, so I think that is very much an opportunity—and that is \$900 billion. I am sorry. I didn't mean to shortchange it. Learning what we found has worked, learning within the government what has worked and sharing that information would be very helpful.

Secondly, the selection of the technologies that are supported in the research. Clearly what would be most desirable are making sure that those that are supported are ones that can track private capital to be able to become commercialized that had broad appeal within the private sector and have an opportunity for return so that the private capital can be applied to it.

And third, related to that, focusing on broad-based projects, technologies that meet both critical national needs but also are deployable and useable in a number of different sectors of the economy would be valuable, so those are three things that we would suggest.

Chairman GORDON. Thank you. I don't want to impose on the Committee's time any longer. But Mr. Hall, before I yield to you, let me just quickly say to this panel that your staff has been very good to work with as we have gone through this bill. We are going to have several more hearings in a few more months that are going to be dealing with this. We want to continue to work with you, and we will probably send you questions, and I am not going to ask for an answer now but I want one later. Mr. Engler and Ms. Wince-Smith, you have both talked about the manufacturing sector, and we are interested in authorizing comprehensive manufacturing research and development programs and we would like to see your suggestions on that.

So now, Mr. Hall, I apologize for the overtime and I yield to you.

Mr. HALL. If you think 20 million jobs in 10 years is tough, you ought to have 10 questions in just five minutes. Bear with me.

As recommended in Mr. Donohue's testimony, this Committee should be, quote, "vigilant about duplication of funding of efforts among the Department of Education, the National Science Foundation, NASA and the Department of Energy and other federal agencies." This was a major concern of ours when this Committee considered ARPA-E. Likewise, we felt that some of the STEM programs established within DOE [Department of Energy] are repetitious of existing programs. I would ask you all to share with me those programs that you consider to be duplicative in the current version of COMPETES or may have the potential for duplication in the reauthorization, and because I don't have time to get from each of you, I will send each of you that question and with the chairman's good agreement we will put those into the record. I will go to the other question that I have. I am trying to save time.

In 2008, the U.S. trade deficit in high-technology products was \$55 billion, up from \$16 billion in 2002. The U.S. trade balance in high-technology products was last in surplus in 2001. So a portion of this deficit is from U.S. companies that manufacture overseas and bring the products back to the United States. Even if we invest in STEM education programs and attract more professionals into high-technology fields, how do we encourage companies from taking production outside the United States other than treat them right when they are here. Thank you, Governor.

Governor ENGLER. I will be glad to start on that. There are several factors in that question. One that many Members of Congress are now focusing on, the Administration I think is focused on, is reform of our antiquated export control laws which have actually cost us high-technology exports in this country while our allies have been happy to fill the gap, and we have got Cold War language in the statute and we really think that while you protect national security, you also need to recognize that national security ultimately is harmed if we end up with our manufacturers going out of those lines of business because they can't compete with the British company or the Germany company, so that is a factor.

A second is one that Mr. Donohue mentioned is on export promotion. We think that a lot of this technology in the hands of small or medium-sized companies, if we looked at exports in a macro sense, agriculture annually exports what manufacturing exports each month, so we are roughly 10 to 12 times the size, yet the agriculture export promotion budget dwarfs the Commerce Department export promotion budget, so there is an imbalance. I am happy to support and have an ag background. I am happy to support agricultural exports but we need to level that up. Again, that is something that Tom Donohue talked about.

The other factor that I would say in terms of your—and I think there has been a lot of confusion on the way the tax laws work but I believe that we today have policies that inadvertently have resulted in almost disincenting the location here. In effect, we have chosen not to make the R&D tax credit permanent. It has now fallen to—it is about the 17th most useful R&D credit out there in the world today. We were in the 1980s far and away the leaders there. So we are losing that competition. In addition, there are a number

of other incentives that countries offer that sort of are added on to that and then when you look at the ability of other countries to impose in their countries territorial tax structures, we try to do a worldwide one and in effect punish you if you try to bring the capital back home. We are in effect creating an incentive to keep capital offshore and that desperately needs to be addressed and I think all of that would lead to more investment at home and additional export opportunities, so that would be the view of our manufacturers.

Mr. HALL. Governor, that is very great and being specific on other regulatory barriers that you all see that we can correct. Anyone else want to address that?

Ms. WINCE-SMITH. Building on what Governor Engler said, I want to emphasize the importance of the entire capital cost structure and the regulatory environment for manufacturing, taking into consideration that our tremendous standards on safety and health really are the best in the world, and we want to maintain those standards. We have a collective set of permitting and regulation that makes it very hard for some of the advanced technologies that we don't want to deploy in the United States to be done here. Product liability is a perfect example. I mean, if we want to do the R&D for next-generation batteries, are we going to be able to actually manufacture these here? I will also give you the example of the flat-panel display industry. We invented every technology path for displays in the United States, and we did not make them here, and a lot of work can go back and show why. It was a combination. But the rest of the world is creating policies to attract and keep this manufacturing. In fact, Sweden has a lower capital cost structure than we do for manufacturing and we think of the Nordic countries as having one of the highest in the world.

Mr. HALL. I thank you.

Mr. Castellani, do you have——

Mr. CASTELLANI. Just two things briefly. One, let me reemphasize what has been said. We have a tax structure in this country that acts as a disincentive for U.S. companies to participate in world-wide markets from a U.S. base. Even countries like Japan and the United Kingdom last year recognized that they had to change and did change to a territorial system. We are uncompetitive with our tax structure.

Secondly, because of the political environment around trade and trade agreements, the rest of the world is continuing to negotiate market opening opportunities for activity from their countries in other countries while we have not been able to forward a trade agenda. We need appropriate trade agreements to be able to invest, to be able to export, to be able to participate in those economies around the world.

Mr. HALL. I thank you. I think that is all the time I have. But your answers will get to every Member of Congress because they are being printed and taken down by—Mr. Donohue, did you want to say a word or so?

Mr. DONOHUE. My colleagues have done such a good job on this, I would just say amen.

Mr. HALL. Thank you. I yield back my time.

Chairman GORDON. Thank you, Mr. Hall.

This Committee is going to do what we can for competitiveness. I think you are going to have to go by and have a talk with Ways and Means, though, to take care of those other issues.

Ms. FUDGE, you are recognized for five minutes.

Ms. FUDGE. Thank you, Mr. Chairman, and thank all of you for being here.

My first question is to Ms. Wince-Smith. You mentioned in your written testimony that Innovate America called for the creation of regional innovation hotspots. I am very interested in this concept as I represent a district that has the potential to do so much. I mean, we have great research universities, an extensive biotech industry, biomedical research facilities, NASA Center and STEM high school as well many other stakeholders. Could you just elaborate for me briefly on some of the criteria that you would designate a region as an innovation hotspot?

Ms. WINCE-SMITH. Thank you. Well, of course, this concept of regional innovation hotspots has been at the heart of the Council's work now for many years because people live and work and innovate in regions. We can set national policies, but the actual delivery of the goods and services occurs where people live. Clearly having world-class universities and the network of community colleges around them are critical to this because this is where the knowledge and the talent generation occurs. Then of course, having a set of policies that support investment and keep investment as part of this menu for the regional innovation hotspots is also important and the thing I would emphasize most importantly in regions such as yours where there is a lot of success and movement is that the different stakeholders have come together in leadership networks. So if you have foundations in regions, they are coinvesting around their particular strengths and assets. If you think of places like the Midwest, the heartland of our manufacturing, they are now moving to create the green manufacturing clusters and ensuring that all of their investments and their skills are aligned around that. And one of the things we should be proud of in the United States is that the rest of world does come to look and see how we have done this in our regions. We need to take it to the next generation, and many of the things we are talking about here will be part of that process. Companies stay and go and invest in places where there is a dynamic economy of creativity and talent and infrastructure to build on.

Ms. FUDGE. Thank you very much. And by the way, I am from Cleveland, Ohio, so——

Ms. WINCE-SMITH. And I am from Akron.

Ms. FUDGE. And you did raise something that I would really like for all of you to respond to, and that is, the question is, what is the role that community colleges should play in workforce training. We have sent a lot of money to community colleges through our stimulus package. We have looked at how we increase getting students involved. What do you think that role should be across the country for community colleges?

Governor ENGLER. Congresswoman, I think that community colleges have a vital role to play because they are by their nature regional and by their hiring ability able to bring the right personnel in quickly when things change or when they are shifting. I person-

ally think that community colleges need to be sort of looking down the line. Community colleges over the years have had visions in their head and they will become a four-year institution by becoming a college. Well, what they need to be—they need to look at the 11th and the 12th grades. I think there is a wasted senior year in a lot of programs for the non-college-bound and I think there is the possibility in this country to take the 11th grade and 12th grade, year one, year two that are the normal associate degree, look at four years becoming three—that is a big cost savings, really—and allow for that specialization to come earlier with these young people choosing because again, back to the point. Everybody needs to leave prepared either to go to college without needing remediation or to go to the workplace with something that has been measured and certified, and we ought to move them more quickly, and as Deborah indicated, regions have different characteristics, different industries, and that needs to be developed. That way there is no cookie-cutter approach. That needs to be thought through, and that was the whole promise of WIA [Workforce Investment Act] at one time was to try to do that and to integrate that, and I think that there is an area—with Mr. Hall's question about where there is duplication in the workforce area, they are falling all over each other and we can sort that out—simplify it, and I actually think that one of the problems we have got people thinking about workforce is that the peer pressure to go to college is so great. Well, they need to also look at all education is pre-work and so how am I prepared to do some work, and we maybe can make working more attractive if they can realize I can get a higher income if I get prepared earlier, and guess what, you can still go to college. This is America. You can go later if you want to go on and then get a different kind of degree or you can become a Ph.D. in physics like Congressman Ehlers.

Ms. FUDGE. Thank you.

Mr. CASTELLANI. We would certainly agree that community colleges have a critical role. If you look at workforce skills right now, their half-life is becoming increasingly shorter. So as we have to move our economy and as a people that need to learn to accept life-long learning and need to develop what is going to be critical basic analytical skills for all jobs, community colleges play a very critical role in that and they should be looked on to play that role.

Chairman GORDON. Thank you, Ms. Fudge.

Ms. FUDGE. Thank you so much. I yield back, Mr. Chairman.

Chairman GORDON. We could have a three-day seminar on this, it is such an interesting topic, but I will ask our witnesses to be a little more crisp and we will try to get back on time. Comrade Rohrabacher, you are recognized for five minutes.

Mr. ROHRABACHER. Comrade Rohrabacher? All right. Well, thank you very much. After what happened in Massachusetts last night, I understand.

A couple things. First and foremost, when we are talking about innovation and especially STEM education, et cetera, but are we not dependent on patent protection for our innovators? And I can't help but have noticed that the patent legislation that was passed by this Congress that is now waiting action over in the Senate has been applauded in India and China as favoring infringers, espe-

cially in the sense that we are trying to take out triple damages that have some major companies intentionally infringe on a small inventor. We are trying to take away that right of having triple damages against that company. How do you stand on that particular issue, if you could just very quickly?

Ms. WINCE-SMITH. I think that protection of intellectual property is one of our most critical issues and that we have to be very, very vigilant across every sector: I have many concerns in that legislation, and indeed the rest of the world, is going to continue to use our intellectual property as a building block and this requires change.

Mr. ROHRABACHER. And the triple damages, you are not in favor of taking that out of the current law?

Ms. WINCE-SMITH. My personal opinion is that taking it out should be very carefully considered.

Governor ENGLER. If you are going down the line, I think we have tried to—we think patent reform is useful but there is clearly two different philosophies with the tech community on one hand and they are going to invent it quickly, use it quickly and move on to the new, new thing. Manufacturing—and I would include pharmaceuticals and others in there—have much, much steeper upfront costs and then need a longer time to recover. That is true with a lot of manufacturing processes and a lot of—so we are hoping that Congress in its wisdom, and this has been a debate that has been raging for too many years, perhaps, is going to be able to divine a way to deal with that so that we have protections. The other thing we need——

Mr. ROHRABACHER. Before you go on, because we only have a limited time, let me just note, the electronics industry does have a different interest in mind but that is against intellectual property protection. As you were just stating, they want to move on. They want to use something and move it on without paying royalties, and they have a different interest than other major scientific industries. So are you in favor or opposed to the triple damages?

Governor ENGLER. We have not supported the effort that passed the House hoping that there was a way to find a more effective compromise on this.

Mr. ROHRABACHER. Well, specifically about triple damages. That is what the House is trying to take out. Our bill tried to take that out.

Governor ENGLER. I don't—I am not——

Mr. ROHRABACHER. Uncertain?

Governor ENGLER. I want to check on what I have actually said before, before I say it again and wrongly.

Mr. ROHRABACHER. Okay. Mr. Donohue?

Chairman GORDON. That is good advice for all of us.

Mr. DONOHUE. Congressman, we have all walked on a tightrope on this issue. The pressure over in the Senate on some of the industries not to try and cut a deal with other industries has been difficult. The bottom line is simple: both groups of industries can agree on a series of common interests and then they have some specific interests, and we have got to get together and put together in this Congress and in this Senate and with this White House a system that works because we are being disadvantaged around the

world and we need to do it, and I don't have anything to say about the triple damages because then I would put myself in the deal about sooner or later the three of us are going to end up in that deal.

Mr. ROHRABACHER. Okay. Well, let us just note again it has been applauded, what we passed in favor so that whatever interest the electronics industry has had here to win favor by them has won applause in China and India while they are just waiting to be able to have a great chance to infringe upon our innovators. That is not a way to build trust and to build an economy.

Mr. DONOHUE. That I agree with?

Mr. ROHRABACHER. Triple damages?

Mr. DONOHUE. No. I agree that it is not the way to build trust and to build our economy. We need a piece of legislation. We need to put the common interests and then the individual interests into one bill and we need to get it done because we are losing without it.

Governor ENGLER. And we need to support a Customs and Border Patrol that thinks this is part of their job too, which they at present do not.

Chairman GORDON. Thank you, Mr. Rohrabacher. I think you got lost on your way to the Judiciary Committee this morning.

Mr. ROHRABACHER. Well, I should note, Mr. Chairman, that when we are talking about innovation, it is a lot wider than just we need more money here on various bureaucratic research projects.

Chairman GORDON. Mr. Costello is recognized for five minutes.

Mr. COSTELLO. Mr. Chairman, thank you, and thank you and Mr. Hall for your leadership on this issue and for calling this hearing today.

A question for each one of our witnesses. We often hear that there is a shortage of highly trained American scientists and engineers. I wonder what the track record has been from your member companies in hiring scientists and engineers over the past few years or let us say the past five years.

Mr. CASTELLANI. We have to divide it between the current economic situation and, shall we say, normal times. But indeed, there has been a shortage, lack of critical skills. Particularly, engineering and scientific skills have been a problem that our companies have pointed to regularly. Even now at the height of the recession, unemployment among engineers is 3.9 percent, which would be the envy of any other skill set. So it remains a problem, particularly in the future as the workforce that has those skills ages and retires.

Mr. DONOHUE. Congressman, we will continue to have serious shortage of skills because the demand curve is going up faster than the supply curve. The suggestions that have been put in and implemented in this legislation have started at the bottom, bringing people along who will eventually get into that curve. We must continue H-1B and related visas, and we have a new problem. For years we have brought people to the United States to train at our universities from countries around the world and then after they became very skilled we were able to talk them into staying. We would get them a different visa, they would go to work in impor-

tant companies or universities, and now they want to go home because the extraordinary—for example, in India, to go home, work for three years for one of the big companies over there, maybe even one of our companies, and then they all want to start their own business. It is very, very hard to keep the people that just a few years ago we were able to encourage to stay.

Governor ENGLER. I agree with everything Tom said and would add to it that the other complicating factor is, it is the competition for the best talent. It is like the NBA. It is our basketball league but they will take the best players wherever they can find them in the world. That is true in science and engineering, and if we can't find them here or we can't bring them here or we can't keep them here, then they are going to go elsewhere, and as Tom testified earlier, 95 percent of the markets in other places in the world, it is a rare company today that isn't getting 50, 60, 65 percent of their sales from foreign sales and so the idea that we will make it all here, we will invent it all here and sell it all there is not going to hold up and so we are going to have to, I think, recognize what are the competitive factors that allow us to make sure we can develop our own but then keep the best of theirs if we can.

Ms. WINCE-SMITH. I would just add to that, that in addition to the science and technology skills, this concept of having an engineer that is not a commodity engineer is very important for our competitiveness. While we haven't talked about it here, ensuring our STEM initiatives should also be coupled in our education to make sure that our young people have languages, they understand history, the humanities and the arts because bringing those things together creates a future worker that is going to have the creative capacity in the next stage of innovation. And one place that does this, and I am prejudiced but I want to share it, is at the U.S. Naval Academy. I think it is the only place in the country where no matter what your major is, history, Arabic, whatever, you also end up with a full engineering degree and that is an incredible set of skills for going forward in the 21st century economy.

Mr. COSTELLO. I thank you.

Thank you, Mr. Chairman.

Chairman GORDON. Dr. Ehlers is recognized.

Mr. EHLERS. Thank you, Mr. Chairman, and thank you so much for holding this hearing and I hope we have many more that are this good. I thank the panel too for their expertise. But I was reflecting here while I was waiting for my turn to speak. Next Sunday will mark the 16th year that I have been in this body. I am the son of a preacher and I inherited his characteristics so I have been preaching to my colleagues, to the country, to the world for 16 years precisely the things that you are saying. Frankly, having you here and saying these things, I feel as Billy Graham did when he had a successful altar call. You are really right on target. What is discouraging is that has taken 16 years to reach this point, and even with the America COMPETES Act. I worked on that issue for a number of years. Fortunately, it all came together when I managed to convince the Bush Administration over with Sherry Boehlert and Frank Wolf at a breakfast meeting in the White House that they take this on, and the President fortunately was eager to do it and the America COMPETES Act resulted with a lot of col-

laboration. But so much of what you said indicates the problem. Governor Engler, for example, you mentioned STEM issues, the MEP and so forth, and your example of agriculture versus manufacturing is a very important one because I have used an example from that in all my years of arguing to get more money for MEP, and strenuous arguing and lots of time and we just managed to keep it stable, and that is absurd. We have had a cooperative extensive service in agriculture since about 1860, somewhere in there. At that time, 80 percent of the workforce was on the farms and so it made sense to have a very strong activity there. Today, less than 2 percent is on the farm and we spent roughly \$400 million a year on the Agriculture Cooperative Extension Service. I don't regret that. I think it is valuable. But we are spending less than that on the Manufacturing Extension Partnership, which is the manufacturing cooperative extension service, and I have been unable to bring that up, even though I point out less than 2 percent of the workforce is in agriculture and 14 to 15 percent of the workforce is in manufacturing. Why haven't we changed that ratio yet in terms of MEP? And hours and hours of discussion, I convince people one by one, but it shouldn't be that hard. And if we have as much support from all the manufacturers and their sector and as much support from the schools, school boards and faculty as we have from the four of you, we would be far, far further ahead in solving this problem.

In the meantime, our country, I am afraid, continues to go downhill in manufacturing as evidenced during the time I have been here, particularly the last 10 years. You are right on in your responses. The chairman and ranking member were right on in saying what has to be done. The problem is not in this Committee. At one time it was in the Education and Labor Committee, and Newt Gingrich, who is one of the most farsighted individuals I have worked with in the Congress, deliberately stuck me on the Education Committee to try to resolve that problem. Again, we made a lot of progress. But somehow you have to be engaged and your colleagues, and by that, I mean all of manufacturing have to be engaged with the other Members of Congress to let them know what is really going on in the world and what we have to do if we as a Nation are going to survive and continue to be leaders of the world in research, in education, in manufacturing, and most people simply don't realize that. I come from a manufacturing state. A lot of people in Michigan recognize that. But in many parts of the country, that is simply not true and so thank you so much for being here.

I don't really have any questions except one extremely trivial one for Mr. Castellani, and that is, do you really own a roundtable?

Mr. CASTELLANI. Indeed we do.

Mr. EHLERS. And is it circular or spherical?

Mr. CASTELLANI. It is circular.

Mr. EHLERS. Then it should work. But thank you very much for being here and thank you for your testimony.

Chairman GORDON. Thank you, Dr. Ehlers.

Mr. Smith, you will have an opportunity to rebut the agriculture issues a little bit later, but right now Mr. Wu is recognized.

Mr. WU. Thank you very much, Mr. Chairman.

Ms. Wince-Smith, you might be the lead person to address this inquiry but perhaps the rest of the panel would be interested also. A couple of organizations, I believe the Information Technology and Innovation Foundation and Brookings, have surfaced the idea of taking a systematic look and work in innovation, perhaps setting up a national innovation foundation or such organization, not so much to engage in the individual innovative ideas process but to look at the process overall, to understand it better and then to advocate for it at local government, national government and to work with the private sector on setting up better conditions for innovation where apparently other nations have been focusing on this process, and while we have been great innovators in individual ideas, we are in the process of developing an overall approach which I believe your organization has been working on for some time now. Could the panel address whether we can make some gains in our capacity to innovate by setting up basically an organization to do for innovation what perhaps NIH [National Institutes of Health] does for the life science enterprise and other organizations do for other parts of our technology and science enterprises?

Ms. WINCE-SMITH. Thank you, Congressman. Well, let me just start by saying that as we are hearing today, innovation is an ecosystem that involves everything from the R&D, tax, regulatory, workforce issues, to manufacturing and national security. I think the biggest challenge for the United States both in the government and also in the private sector is that we don't look at it in the systemic way and we still operate in stovepipes. Even in the Federal Government—and I served in the Federal Government myself and it is still going—while we have committees, we don't really pull together the pieces, so if it is an antitrust, a product liability issue, just as one example, that stays in the Justice Department, it is not brought in at a systemic level, and similarly on trade and other matters. And so I think one of the first things, which was a recommendation of the Council's and is in America COMPETES, in the Federal Government, let us get the White House to pull together the Cabinet officers to focus on a systemic innovation policy. In the private sector, the council and our colleagues around the table, we can all do that together but we need to connect the dots, and Brookings and other groups are very wise in talking about this. Whether the foundation is the optimal mechanism or not. I wouldn't perhaps want to comment as much, but we need to do this in the Federal Government and we need to have private-sector groups that also come together to look at the system of innovation, and that is what our competitors are doing.

Mr. WU. Thank you very much. Would anyone else like to comment?

Governor ENGLER. I would add this, that what Deborah Wince-Smith said about an ecosystem is really important, and I think markets are beautiful things. I think they drive the dollars where they need to be, but I worry that—take nuclear power, for example. That is all our technology and it is being implemented around the world. There is a great need for reprocessing, waste minimization there. Other countries have stepped way ahead because we backed way off. Clearly, I think envisioning a low-carbon future, nuclear power has got a big role to play but we haven't let that go forward.

Medical tools and devices, we were talking earlier. I look at that. We are clearly the world leaders. In every other nation where there might be a department of innovation, they would probably be really promoting that, how can we grow that industry? We are debating whether or not there should be several hundred million dollars in new taxes applied to that as opposed to what the export strategy might be to grow our dominance. So I am not sure centralizing it is the answer but I do think that the right incentives where we want to be, and I think one thing that has been done well here is battery technology. Congressman Peters knows. Right in his own district there has been significant investments there to try to catch up. There are some really big things where I think the Federal Government through the old DARPA [Defense Advanced Research Projects Agency] programs, you know, under defense or much of, you know, science programs through universities, those are great, but whether we centralize it or not, I would be a skeptic preferring maybe the markets to work.

Mr. WU. Well, I don't think the concept is a centralizing one so much as to try to understand it and promote it elsewhere.

Chairman GORDON. Thank you, Mr. Wu.

Ms. Biggert is recognized for five minutes.

Ms. BIGGERT. Thank you, Mr. Chairman.

There is so much I want to ask but I don't have time so I am going to try get as much in, but thank you all. I have a great district and I have a district that really has a lot of development, a lot of innovation and creativity and companies and a lot of these are startup companies and they will come in and say they have this great concept. They maybe have a demonstration program but they need help and they need help in funding, and particularly in this economy where there isn't the venture capital available and so they come in and say what can you do. Well, they are in what we call the valley of death. They are in between demonstration and commercialization so investors don't want to take a chance, that is this really going to go or not. Is there anything—you know, we talk about the America COMPETES, ARPA-E is a possibility. We have got a couple of them we have sent to DOE and actually DARPA has been available for them. Is there anything that you could recommend that should go into the America COMPETES Act that would help as far as that investment or what to do within the private sector? We are missing so many, you know, really great concepts that take so long to develop that we could be using right now.

Ms. WINCE-SMITH. I would just add one that is very important, and some states are doing this, and I don't know if it is across the board yet in the Federal Government, but that is, extending the Small Business Innovation Research [SBIR] provisions beyond stage two into stage three that takes a company farther in to the commercial prototype demonstration phase. I remember years ago when the Japanese were investing in our startups. They used to say let us look for those companies that have SBIR phase one and two because they don't have the capital to go to the next phase, we will come in and swoop up that innovation. Let us invest farther along on SBIR, and that is something that the federal agencies could contribute to.

Mr. DONOHUE. You know, that is exactly how private equity people look at sound investments. You are exactly right. This is a valley where it is hard to get capital and funding and there are all sorts of people with great ideas. One caution I would make to the Members of Congress, while it looks like a wonderful idea to go out in need of money and drive up the taxes on individuals, that is where the greatest amount of investment capital comes for startups. You know, if you go talk to people that are entrepreneurs and say "how did you get started?" they didn't do it in a bank. The banks lend money to people that have money. That is the way the structure is. So we have got to be very careful that we keep individuals in a position to support innovation and to support folks they know, and then of course, the second place for money is from larger companies who find this as a great place for their own research and development and it is often cheaper for them to buy it than it is for them to develop it.

Mr. CASTELLANI. One of the things the Chairman mentioned before the hearing began is something that I think this Committee can look at and certainly is within the purview of this Committee, other things are outside, obviously the tax code and some other support programs, but one of the difficulties that we see in this area is making the connection between those who develop the technologies and those who could see an application for those technologies, and finding a way to protect the intellectual property but get more information out more broadly to both potential users and investors about what technologies and their attributes might be available, what their time horizons are, what it would cost, what their advantages are, is something more of a national exchange opportunity and something that would benefit those companies.

Governor ENGLER. I would just add a couple quick things. I mean, that is what the R&D credit in part was for, and probably this is where your capital gains treatment and some type of accelerated write-offs so you can encourage investor pools. There is private capital out there. I think we need to try to make this more attractive. Again, I am not sure that I would trust an agency to do the selecting there. States will do it if they view it as critical sometimes to existing but those are very limited funds and so I—it is 11:30, Mr. Chairman. I need to step out and make a quick call. I will come back and rejoin if you are still in session. I don't know long it will be.

Chairman GORDON. Thank you, Ms. Biggert. I will point out that the old ATP [Advanced Technology Program] program was a vehicle for that and that has been changed now and it is called the TIP [Technology Innovation Program] program, and it will be a part of this authorization.

Another thing that we mentioned earlier about how there will be a fair around the ARPA-E-type proposals. The problem with bringing private-sector dollars in, and we are really looking at that, is obviously they want to come at different levels, venture capital at one place, private equity another place, but that is—we will have some hearings on that, how we bring more private-sector dollars in.

Mr. Peters, you are recognized for five minutes.

Mr. PETERS. Thank you, Mr. Chairman. It is too bad Governor Engler had to step out because I actually had a couple of questions

related to MEP. Bad timing there, but we will have an opportunity to follow up.

I just want to concur with my colleague, Congressman Ehlers, on the Manufacturing Extension Partnership and how important that is, and for the panelists, we have actually introduced some legislation together, both Congressman Ehlers and myself, dealing with the funding issues related to MEP. As you know, the states have been stressed, particularly our State of Michigan. It is a critical program for us in that State to help our small manufacturers as we continue to hemorrhage manufacturing jobs, and the bill changes some of the contributions. Right now two-thirds of the contribution for MEP comes from states and yet those states that are hit the very hardest and need the services of the MEP are having difficulty coming up with those matching funds. It would change that to a 50/50 match, which would allow these critical programs to continue and certainly hope that your organizations would be supportive of that effort and are supportive of MEP. I assume in addition to Governor Engler, all three of you are also very supportive of MEP? All are nodding, so for the record, please reflect that all three are nodding in strong support for the program and will continue to move.

Chairman GORDON. And Mr. Peters, we will be reauthorizing MEP in the COMPETES bill.

Mr. PETERS. Right.

Chairman GORDON. And we will be having hearings to see how it can be fine-tuned for what we might call the 21st century in contrast to when it was originally authorized.

Mr. PETERS. Great. Thank you, Mr. Chairman.

I want to ask a little broader question of all three there, and we have had some discussions, and Ms. Wince-Smith has addressed this as well, but kind of get your reaction to R&D investments generally and whether or not government investments in research and development are going to have the same kind of impact that we have seen in the past. Certainly as we are talking about globalization, technology transfer is extremely rapid, and as soon as technology is developed in one place in innovation, it is quickly picked up somewhere else in the world due to other cost structures that exist—labor, technology, regulations, things that you have brought up. How should we be thinking as COMPETES Act, how effective will this be given that kind of rapid transfer and do we need to be really talking about manufacturing policy in total in addition to COMPETES because we are simply not going to get the same kind of bang for our dollar as we have done in the past. What should we be thinking about?

Ms. WINCE-SMITH. I think, Congressman, you just stated in your last comment very much we have to think of a national manufacturing strategy that encompasses all the things in COMPETES but also takes us into some of these other spheres that relate to capital cost structures, regulatory environment, exports and trade and look at that as something that is systemic. But in terms of R&D, we must invest in R&D, we must invest in the frontiers and we must link the private sector to these tremendous investments in the frontiers of knowledge.

Mr. DONOHUE. I believe that government gets a significant return on the frontier investments. I mean, going to the moon, running the space shuttle, very forward-thinking activities at NIH, those kinds of investments are fundamental.

The second thing that I would comment briefly on, you are exactly right that as soon as we come up with an innovation, everybody all over the world is trying to figure out a way if not to borrow it, to use it as a leader for their own innovation. But Americans are beginning to be able to look around the world now and find things as well that they are able to inculcate into their businesses and their processes.

The third point I would make while we are talking about manufacturing, the often overlooked competitive issues here are supply chain, are transportation, are all of the technology and software around that. The greatest increase—one of the great increases in productivity in this country came during the Clinton Administration when we put together information technology and supply chain management, and it is one of the things that keeps us somewhat competitive in the manufacturing area, even though as the governor indicated, we have serious disadvantages in tax policy and regulatory policy. You know, competition drives innovation. Regulation stifles innovation. Now, we need regulation for safety and all of that but we have to be very, very careful when we are looking at competing around the world that, you know, it is always a great idea to start a new group, but let us go back and look at what we do to help the process or to hurt the process, and you can change a lot of things by simply getting rid of the hurt and maximizing the help.

Mr. CASTELLANI. Two quick comments. One, focusing on those technologies that are broadly applicable within the economy is key. That way you don't have to pick winners and losers, although the normal process of development will produce more losers than winners. Secondly, as important as the manufacturing sector is, and it is very important as high-value-added activity, these technologies and these activities also have beneficial impact within the services sector, within the transportation sector, within the hospitality sector. Tom mentioned one that has been the single biggest driver of productivity improvement in this country over the last 10 years, and that has been information technology.

Chairman GORDON. Thank you, and Mr. McCaul is recognized for five minutes.

Mr. McCAUL. Thank you, Mr. Chairman. I, as you know, supported this, the COMPETES Act. It was really a response to the "Rising Above the Gathering Storm" report, which was a bit of an eye opener, and I support the idea of federal investments in R&D and public-private partnerships with universities. Certainly NASA, close to my district, has been a beneficiary of this. NIH has done a fantastic job. But I want to follow up on Mr. Donohue's comments.

You know, the President signed a stimulus bill into law. It is about 5.4 percent of our GDP. Unemployment has gone up over 10 percent. The federal debt is above \$12 trillion. And there comes a point where we get overleveraged in the Federal Government. Any private-sector business that overleveraged wouldn't be able to stay

in business. And I think there is a healthy balance between the federal investment of dollars and public-private partnerships versus what we can do at the federal level to incentivize the private sector, and I think that is the philosophical debate we are having in the Congress right now. And so in terms of job creation, because both sides, we want the same thing, both Democratic and Republican. We want the economy to rebound. We want to create more jobs and good jobs in the United States and so with all of your experience in the private sector in the business world and for the panel as well, I would be interested in your take on this balance, if you will, that we have to provide up here in the Congress.

Mr. DONOHUE. Congressman, if I might just comment a minute about this. There is no question that the federal deficit is a serious matter, growing and compounded in a significant way, a lot of it being driven by programs that are entitlements that just grow themselves and these are serious matters. It is not a Democrat or Republican issue. So everybody says we ought to deal with that but trying to deal with that issue without first dealing with the questions of employment, as you indicated, is counterproductive because you are just going to keep driving up federal support programs. So our issue here is to say here is a plan to create jobs. Hopefully as we go forward, we will be careful not to be adding unnecessary federal spending, and as the economy grows we are going to be in a much better shape to attack this deficit. You ask a fundamental question: when can the government—when should the government stop investing in significant ways and hope the private sector will take a larger role. And I think if you look at the suggestions of expanding trade, expanding infrastructure, being very, very careful on our re-regulation of the capital markets that we could move efficiently in that direction. There is one crippling issue keeping us from creating more private-sector jobs: it is uncertainty, uncertainty about what tax policy is what going to be, uncertainty about health care policy, uncertainty about climate policy, and if I walked into John's office when he was back in the private sector and said let us create 500 new jobs, he would throw me out because he would say I am uncertain about this, I am uncertain about that; until I get some amount of certainty, I am going to keep my cash in my jeans and I am going to hold off.

Mr. MCCAUL. I couldn't agree with you more. I think the uncertainty here in Washington with a lot of the policies coming out is that uncertainty is keeping a lot of capital on the sidelines and not investing in the private sector. Any of the other two witnesses like to comment?

Mr. CASTELLANI. One of the things—I mean, certainly I agree with what Tom said, although I never wore jeans to the office. The uncertainty is certainly a big part of it. Obviously there is a role for the government. The government needs to do those things that the private sector cannot do, and a lot of what is in the America COMPETES Act are things that the private sector cannot do without government help. But one of the things that we face day in and day out in terms of making decisions on where to invest and in what to invest is the needs of our shareholders, and that is, getting them a fair return for the money that they have given us to be stewards of. The United States is suffering from what we all recog-

nize, and that is that we have the second highest corporate tax rate in the industrialized world. That has an effect. We have a tax structure that disincentivizes exports and participation in an international marketplace where 95 percent of the world lives. That has an effect. We have a start and stop incentive system for research and development where other countries in the world do not have it. That has an effect. All of those things have an effect on where the capital goes. Our shareholders are not nationalistic. They want a return for their investment. Our obligation is to give them that return and so addressing those fundamental issues is as fundamental to being able to be competitive as what you are talking about in the America COMPETES Act.

Chairman GORDON. Thank you, Mr. McCaul.

Mr. DONOHUE. And John, you would say you have global shareholders.

Mr. CASTELLANI. Absolutely.

Chairman GORDON. And thank you, Mr. McCaul.

With no objection, we are going to move forward with those Members that haven't had a first question. If there is a request for a second question, later we will do that. I am also going to request that Members try to hold their questions to about three minutes so that we can try to get through everyone, and that will encourage you to get here earlier next time.

Mr. Matheson, you are recognized.

Mr. MATHESON. Thank you, Mr. Chairman.

You know, one of the issues that is interesting is, we look at the government role in promoting research and development of new technologies, and after that we want to figure out a way to transfer those technologies so the private sector runs with it. And there has been a lot of talk about technology transfer for decades in this town, and over 30 years ago we had Bayh-Dole and Stevenson-Wilder, for example, that tried to pursue this goal. I am curious what your assessment is of how our technology transfer regimen that we have got today works in terms of getting these technologies out to the private sector and how it actually manifests itself and what the ultimate goal is we are trying to achieve, which is not just doing research here but actually creating jobs in America.

Ms. WINCE-SMITH. I will comment on that. Certainly, you know, with the creation of Bayh-Dole and the whole legislative framework, we again led the world in these new public-private partnerships to capitalize on the R&D invested by the taxpayer. Intellectual property issues have become a challenge in that rather than making the intellectual property a baseline for establishing these partnerships, they often become the hurdle and slows up the process, and that is something that across the board I think the community would say is an issue.

The other challenge we are seeing in different parts of the country with our national labs and universities is how they bring companies and partners in from the beginning to work with them, as opposed to waiting until you throw something over the fence which has emerged as the best practice to create the strategic R&D partnerships such as ARPA-E is going to do as opposed to treating this as a linear sequential process. Certainly, U.S. companies and chief technology officers in the Council on Competitiveness are very com-

mitted to working on this very topic, and we have formed a working group under our Technology Leadership and Strategy Initiative to address that, and would like to report back to this Committee on our findings.

Mr. DONOHUE. I just have one very quick comment. There isn't a bright line between the government and the private sector. When a government agency whether it is NASA or it is the military or whoever it happens to be, NIH, standards, bureaus, others, when they are doing the work that is being pushed by the money that is used in the government, they are doing it in partnership with the private sector. They are already transferring technology and know-how by the people they contract with to get this work. The perfect world wouldn't have the obstructions we have but in the perfect world we wouldn't have so many lawyers, except in the Congress.

Chairman GORDON. Thank you, Mr. Matheson.

Now we have a real live small-business owner, Ms. Dahlkemper.

Ms. DAHLKEMPER. Thank you very much, Mr. Chairman. I was hoping to have Governor Engler here. I appreciate his mentioning my cosponsorship of the AMERICA Works bill, which I think is a great piece of legislation. In his testimony, he mentioned the need to ensure that STEM education spurs the interest of students in manufacturing careers, so I guess I just want to ask the three of you, because I agree with this, but how do we build that bridge between the STEM classroom to a career choice in manufacturing and innovation, some concrete ways if you could give us some suggestions how we can make that environment.

Mr. CASTELLANI. One of the things that we have found that has worked very well is where there is real-world examples on how those disciplines can be applied to something that is exciting. You want to capture the imagination of a young person in college. That is how I ended up going into the sciences. I got psyched by looking at some of the research that was being done down the road in Schenectady, New York, and that got me very excited about it. It is role models. I mean, clearly young people want to see people who are successful in those fields. They want to see things that are exciting in those fields. Some of the best programs that have worked is where promising students at the high school level are mentored, are given internships in research labs, in manufacturing facilities, in businesses so they get excited about it and they see people like them, which is one of the most difficult things that we face in what has been unfortunately male-dominated disciplines. We need young ladies to see women who are successful in the STEM disciplines. We need minorities to see minorities that are successful in the STEM disciplines and are excited about it. Those programs tend to work best where they have a real-life example of something that is cool, quite frankly.

Ms. DAHLKEMPER. Do you think we need to do more on the high school level? Because I wonder, you know, how many of our

Mr. CASTELLANI. Absolutely. If you don't capture them at the high school level—you know, there is an institute, the Committee for Excellence in Education, that looks at the other end of the spectrum, which takes the brightest high school students and does ev-

everything you can to encourage them to be in the STEM disciplines, and what they found that worked best is getting them associated with a lab, with a research facility, with a manufacturer, with a business, with scientists, with engineers in high school so that they are excited about that as something to pursue.

Ms. DAHLKEMPER. Mr. Donohue?

Mr. DONOHUE. You know, this is also a cultural issue. After the second World War and the Korean War, there was this tremendous, you know, Sputnik and then go to the moon and there was this massive effort for people to go into engineering. It was the way to a better life and to a great job. Well, we have matured. I will use that word. And now it is hard in high schools, in many high schools to convince people they ought to put all their time and energy into the most complicated subjects. It has—for a while it was hard to have people see a great career there but there is a resurgence of demand and of need. The computer, the tech revolution got that started. People saw that as a way. I think demand and need have a great deal to do to show people where they can do well and where they can do things that they can achieve, not only on a personal basis but a financial basis and there needs to be some of that cultural goings-on. That is what John was talking about. What happened to him, he was in college. He went down the street—

Mr. CASTELLANI. Actually high school.

Mr. DONOHUE. Well, in high school. Good. He went down the street and he got motivated, and he wasn't only motivated because of what he saw, he was motivated because of what people convinced him he could do. I think there is a soft-goods part of this that is as essential as the actual teaching—

Ms. DAHLKEMPER. My time is almost up. Is there a connection with business in this?

Mr. CASTELLANI. Absolutely.

Mr. DONOHUE. Of course.

Ms. DAHLKEMPER. And Ms. Wince-Smith, I will give you my last two seconds here.

Ms. WINCE-SMITH. Well, just building on my colleagues, the Japanese used to say manufacturing is not dirty, dumb, dangerous and disappearing, but that is what we think in our country in many cases, and I like your idea of bringing this to high schools and providing opportunities for young people to actually go into manufacturing operations because the modern ones are extremely high-tech and exciting. I mean, how many have been in a clean room, for instance? And that is something we could all do in our communities and it is something that would have a big cultural shift.

Ms. DAHLKEMPER. Thank you very much.

Chairman GORDON. Thank you, Ms. Dahlkemper.

Governor Garamendi, you are recognized for three minutes.

Mr. GARAMENDI. I thank you very much, Mr. Chairman, and to this Committee, it is a great pleasure to be here and particularly to be listening to this particular discussion, the COMPETES Act and the work that it has done and the good that it has done.

My question really goes to the preparation of these skills, and I am going to go back to California issues and ask the witnesses a specific question, but first let me set the stage here. California uni-

versities, the state universities of California, are in serious financial trouble as are many of the universities across the Nation, particularly the public universities. In California last year and this year, 40,000 students are not able to enter for lack of money to fund the universities. So my question to you is, what can be done about that? All of the talk is good but if there is no money, there is no action, and are your organizations willing to have the tax increases necessarily? Specifically, University of California is short \$1 billion. The state university is short \$1 billion. That is two-tenths, together two-tenths of one percent of the state's economy to find that \$2 billion. What is your view on raising taxes to fund higher education?

Mr. DONOHUE. I got the short straw. Just three quick things. Number one, yes, there are those serious problems in California as well as in other states, and what we are seeing, and I was going to make the point before when we were talking about the community colleges, more and more people—and this is another pressure on the community colleges—are going to the community colleges for the first two years and families find that they can afford that and then might be able along with some federal and state help to get into the universities for the last two years. Now, this creates a problem for the universities because, you know, they sort of make money on the first couple of years where they don't make it on the back years. To the question, would we increase taxes, my view is, first of all, California has a hell of a lot of problems that haven't got anything to do with the education system.

Mr. GARAMENDI. No, in fact, they do because more than half the budget is education.

Mr. DONOHUE. Well, that is—I am thinking about the college education system. I would agree with you because when you teach in the California system and you can retire at 51 years of age at half pay and full medical, whatever the exact numerics are, you have got real serious issues. My deal is, you know, I always thought the issue by saying what don't we have to spend and then how do we get additional revenue and how does that come, some of it should be from the students, some of it should be from the community, some of it from contributions because there are major efforts there, and then if you are down to taxes, that is up to the community. Would I support them? Wait until they are proposed. Now, I mean, look, our deal is everybody, everybody has got a new tax. The President has a whole set of new taxes. All the states have new taxes. All the states, particularly the big states are coming to the Federal Government for money. If you buy everybody's proposal on a tax, we are going to be in serious problems. We need to look at it in totality. We need to do what we need to make this country work. But by the way, we can spend money like nobody you ever saw.

Chairman GORDON. Does any other witness want to address that quickly?

Mr. CASTELLANI. Just very quickly. I mean, business has always been willing to invest in things that pay off but before that investment comes, we have to make sure that we are operating efficiently, and even in the higher education system there are opportunities to overhaul the delivery system through greater use of tech-

nology. You know, I have the honor of serving on the board of trustees in my alma mater in Schenectady, Mr. Tonko, and the inefficiencies that we apply in the higher education structure, to be very blunt about it, would be unsustainable in the private sector. So we need to do a better job of doing that. Then if that is done and we need to invest more, then, yes, we always support those investments if they will pay off.

Chairman GORDON. I think it is appropriate now that we go to a professor, a university professor, Dr. Lipinski.

Mr. LIPINSKI. Thank you, Chairman Gordon. Yes, I was a professor of political science but before that I was an engineer, so Mr. Donohue, I would say yes, we do need to have fewer lawyers in Congress and probably some more scientists and engineers. One thing I agree with you, Mr. Donohue, is on the multi-year highway funding bill. Definitely, we need to do that.

So I think the one thing, since we have limited time here, I want to focus on is sort of playing off of what Mrs. Dahlkemper had said earlier talking about what business can do in partnering, in helping out with STEM education. In my subcommittee, Research and Science Education, we have had a couple of hearings on informal science education, and I think this is an area where it is important also for businesses to get involved. We saw some of the best informal education taking place where business would get together, say, with a science museum or many other ways that they can get together with other organizations to promote informal science education. As you probably know, a couple weeks ago President Obama announced the Educate to Innovate campaign, which highlighted over \$250 million in private-sector STEM education partnerships. These involve universities, large corporations, foundations and nonprofits and government agencies. Now, is there anything more that you think the Federal Government should be doing to be an effective collaborator in these partnerships or to better support private-sector STEM education initiatives, especially in informal education? Whoever wants to start out here.

Ms. WINCE-SMITH. One innovative model that is emerging is that many companies are creating summer STEM camps in their regions and cities to bring in 7th, 8th graders, women and minorities across the board to be exposed to math and science through project-based learning, and, you know, just as companies often sponsor a school, doing these STEM summer camps or something, that is a really exciting private-sector initiative across the country.

Mr. LIPINSKI. And how can government in general—as we move on here, how can government be involved in this? Mr. Castellani, Mr. Donohue, do you have any—

Mr. CASTELLANI. Well, one of the things that I think government ought to consider because it does a lot of this good work also, whether it be at NASA or the national labs is doing the kinds of things that are being pioneered in the private sector. Deborah mentioned a STEM camp but also highlighting the technology. I think Tom mentioned earlier and it was one of the reasons I went into the sciences, I mean in the 1950s and the 1960s—I am giving away my age, 50s—the excitement of the Space Race was what stimulated a lot of people. A lot of what is done in government, particularly in the science areas, not just within the Department of De-

fense but outside of it, NIH, NASA, the national labs, is something that should be looked at as being like what the private sector does, a stimulation, excitement, a point of excitement to get young people interested in, highlight it more, participate more in it.

Chairman GORDON. Thank you, Dr. Lipinski.

I don't want to take time now, but many of those things you are advocating are in this bill, whether it be through the national labs, in a variety of different ways, and so—but we want to continue to do better.

Now Mr. Luján, you are recognized for three minutes.

Mr. LUJÁN. Thank you, Mr. Chairman, and I really appreciate you bringing this hearing, Mr. Chairman, because as we talk about moving forward and spurring economic opportunity and realizing where we have fallen further and further behind in this country, the lack of our ability to get more students in engineering fields and science fields, the creativity, the innovation, the problem solvers that are going to be key to moving us ahead and keeping us ahead are all important policy decisions we have to make and I certainly hope that as we embark upon education reform later on this year that we have an emphasis in creativity, making sure that we are educating problem solvers and that we have a structure that looks like that.

Now, with that being said, with the commitment that it sounds like we all have with creating a systemic innovation policy and moving forward along those lines, and looking to investments that we have made, national treasures in our national laboratories—I come from a state and a district that has one. We have two NNSA [National Nuclear Security Administration] laboratories in New Mexico, Sandia National Labs, Los Alamos National Labs. We have Whit Sands with NASA down in southern New Mexico. And to truly see how we can bridge those opportunities with tech transfer, making sure that we are bringing our universities in and we are looking to our national laboratories to create those public-private collaboratives and partnerships, the investment that is required for the R&D to allow for that modeling, to allow for the simulation to get into the hands of the private sector all sound like things that we agree upon. It sounds like we have support from all business entities, from those of you that are responsible for making sure that we are sometimes representing interests that sometimes compete with one another. But this is certainly an issue that we all can agree upon.

And just to hear quickly from you, from a tech transfer perspective with the problems that you hear from companies that are working with laboratories to get the modeling and simulation in their hands, ideas that you may have on what we can do eliminate some of those barriers, bring that forward and build upon that, and Mr. Chairman, I know we are out of time so I would like to also make these questions for the record, and also to hear your thoughts—New Mexico with Los Alamos National Laboratories, a program has been created where our scientists, engineers and researchers are working with local school districts and teachers, teaching teachers, if you will, bringing them in and then getting those programs back into the school districts. The school districts that have been beneficiaries of these programs have seen their

math scores increase dramatically through the roof, again, teaching kids how to be problem solvers, and I certainly hope, Mr. Chairman, that as we build upon all that COMPETES has to offer, which it is in there, that we look to see how we can incorporate these other ideas and programs that are working and make the investments necessary and truly see the partnership that can come from the government, from the public sector and working collaboratively with our private sector and with our education system to get us moving ahead. Thank you, Mr. Chairman.

Chairman GORDON. Thank you, Mr. Luján. You know, really the basis of much of the COMPETES Act was not trying to create new programs but rather it was to look at the National Science Foundation and elsewhere, what are the programs that are working and scale those out, so that really was the foundation of this.

Mr. Tonko is recognized for three minutes.

Mr. TONKO. Thank you, Mr. Chair. First, let me thank John Castellani for a couple of shout-outs for Schenectady, New York. I know we appreciate that, and I appreciate the panel and their input today.

Let me frame my question first with a couple of comments I heard a couple times over from the panel: uncertainty. I couldn't agree with you more. The certainty is a major factor, but the certainty of an American clean energy opportunity here in this House was passed and we are still fighting the science of having to have a clean energy economy. I don't know how we resolve that. And then also when you speak, Mr. Donohue, about the global space race, we have a global race that we are supposed to be entering now because if we don't, we are going to be letting down generations of American workers. We are still struggling with that issue here. I don't know what it takes. Maybe more engineers in the process. My question is about the role of the clean energy economy. Do you see that bearing great relevance? Is it growing more important as a sector of our economy? And will government funds be required, at least in the short term, to advance that effort?

Mr. DONOHUE. Two points about the clean energy economy. First of all, there are great opportunities there to create jobs through advanced science and to engage people in the process, a significant expansion of the clean coal efforts that people are engaged in on a scientific basis and carbon capture, the issues of nuclear power whereas Governor Engler indicated we have let a lot of that capacity go elsewhere. We now have 26 potential sites there. We can get a lot of money for that. It won't have to come from the government, a little backstop, but you are going to have to assure that after I build it, I can open it and not be stopped by 30 environmental lawsuits because otherwise you are not going to get any money to do that. There are all sorts of issues in a green economy that will create jobs.

There is one other thing to understand, though. if I buy a green refrigerator, I am not going to buy the other refrigerator I was going to buy, so there is some activities that are significant increases in economic activity, some that are substitutes, and one also has to understand that much of the green economy to date has depended on a good deal of federal subsidies or incentives, particularly in alternate fuels and so on. We are going to have to work

our way through this, and it is a long way from start to finish. There are clear benefits if we can rally around it. At the same time, we have to be careful. One of the major issues with the bill that came out of the House, it starts a global trade war, you know, by saying that all we have to do is decide we don't like this country or that country's environmental position and we can put taxes on the products they sell in the United States. We need to take a broader look at these issues. We want a domestic bill and we want a global bill but we want one that keeps people working, that uses technology that we have a lot of engagement in, and that is global in nature. We have got to get people around the world involved. If we don't, we're not taking advantage of it.

Chairman GORDON. Mr. Castellani, do you want to briefly comment?

Mr. CASTELLANI. Yes. In my written testimony, and I am sorry I didn't have time to bring it in the oral testimony, last year we convened a large number of our CEOs to address the issue of what do we do about global climate change, and they divided themselves up into technology sectors and pathways, and our report, the Balancing Act: Climate Change, Energy Security and the U.S. economy, highlights exactly what you are talking about, and that is, irrespective of your position on the regime that is going to be necessary, any regime is going to require substantial investment in technologies, and if we do it smart and we do the whole array of technologies, we can minimize the impact on the economy. So it is absolutely vital to the United States, to this country and to the world for two reasons, the two very important reasons. One, is to have the energy to continue to drive our economy. The other, is to be responsible in alleviating global climate change and global warming.

Mr. TONKO. And perhaps even drive our own energy security.

Chairman GORDON. And if you have something compelling to say, Ms. Smith?

Ms. WINCE-SMITH. I would just say that the clean energy revolution, in addition to energy security and climate, is going to drive how things are made, and that is a tremendous opportunity that needs to be embedded in our manufacturing initiative.

Chairman GORDON. Mr. Carnahan, thank you for your patience, and you are recognized for three minutes.

Mr. CARNAHAN. Thank you, Mr. Chairman.

I thank the panel for being a part of this great national conversation to move us forward. I am from St. Louis and we have got a great science infrastructure there from great companies, great institutions of higher education, and we have seen kind of a tale of two different industries there in terms of innovation. Aviation industry based there has been right on the cutting edge of innovation. Not only do they produce great products for our country but also opened up a lot of markets overseas whereas the auto industry, we have seen the auto industry to be slow to innovate. I think they are coming around but they have been slow and lost a lot of markets overseas. So we also have seen really a disconnect between those great companies and institutions of higher education with some of our K-12 education has not been producing, you know, that new generation, hasn't been capturing them early enough and

our companies are beginning to see that connection, and many are partnering. So really I am pleased to see some efforts there in terms of partnering companies directly with our schools. But I really think, you know, we have seen innovation, you know, the estimates are about half the economic growth in our country from World War II to present was from innovation in new technology. I think we have got to get back to these basics of making things again, and making things that matter, new innovative products that attract people that want to be involved, that can grow jobs here at home but also grow markets around the world, and I think it is certainly key in the energy sector, and also keeping that talent pool here and attracting the best talent from all over the world. I appreciate what you said earlier about that.

One of the ideas that has been put out by Craig Nassey with NIST, he has advocated for establishment of a coordinated national innovation policy infrastructure, that he has said the United States is the only major industrialized nation without an institutionalized science, technology, innovation and diffusion policy development and management infrastructure and that such concepts as a national innovation foundation that have been jointly proposed by Brookings and the ITIF [Information Technology and Innovation Foundation] have not received enough attention in terms of our policy development. I guess I wanted to ask the panel, how do you see that kind of a coordinated national effort really going forward from here?

Ms. WINCE-SMITH. I would just reiterate, Congressman, that the White House needs to take——

Chairman GORDON. Your microphone.

Ms. WINCE-SMITH. Excuse me. The White House should take the leadership to do this; take cross-agency coordination for a national innovation strategy, and I think they are making progress, and the private sector and the groups at the table today; we all work very closely and look forward to working on that issue.

Mr. CARNAHAN. Thank you.

Mr. DONOHUE. Coordination is essential to maximizing investment and competition is absolutely essential to creating the products that make us a leader around the world, and coordination and competition occasionally bump into each other.

Mr. CARNAHAN. Very diplomatically said.

Mr. CASTELLANI. Just like we had in this country for a long time looked at the comprehensive environmental impact of everything that we do from a policy standpoint, it is vitally important to look at the impact on economic activity on the different policy initiatives that we bring on the innovation process and our ability to compete and to win, quite frankly, so that is a very important concept.

Chairman GORDON. Thank you, Mr. Carnahan.

Mr. CARNAHAN. Thank you.

Chairman GORDON. Mr. Rohrabacher, do you have some concluding wisdom for us?

Mr. ROHRABACHER. Well, thank you very much, Mr. Chairman. I want to thank you for your leadership in holding this hearing and I want to thank the witnesses. This has been a very valuable exchange of ideas. Just for the record, I am going to throw out some things that weren't covered just so people can know that that was

part of the discussion, even though it is right here at the end. My belief is that policies that lower the compensation for those people, especially young people, who go into the sciences, technology and engineering eventually work against us by discouraging high-quality people from getting into these areas, so I imagine you would all agree with that.

Let me just throw out for the record, Mr. Chairman, H1B visas bring down wages. H1B visas, I have had people in my district come to me and give lots of examples where businessmen are telling them to take a lower wage because they can get some H1B visa person from India to do the job. This is not good for encouraging more young people and other people to get into the professions of engineering. We need to drive up the wages for people who are engineers and scientists rather than bring them down, and one of the most effective is, we talked about education, but again, let us bring the wages up of people who are involved in this. There is never a mention in education of paying teachers who teach math and science more money than people who teach poetry and physical education, and that would have a tremendous impact on our students by bringing higher-quality teachers because you are paying them more money. More pay will get you higher quality and better people involved.

And last, when we are talking about graduate students in our universities, let us just remember, when we see that 55 percent of our graduate students in these high-tech area are foreigners, that this too is damaging to our country. The fact is, we should be focusing on educating our own young people and filling those slots rather than going to foreigners who by the way subsidize their young people. They come over, they learn a great deal about important scientific endeavors and then they go back and they use that knowledge against us in their own countries, and that is not good.

And one last issue, technology transfer. Any technology transfer, any controls that we have, if loosen those and it results in technology going overseas that will eventually be used to helping their manufacturing to compete with ours is working against our interest and especially it works against us if it puts us in jeopardy and endangers our national security.

Those are just a few thoughts and I thought I would throw them out here at the end of the hearing. My time is up. Thank you.

Chairman GORDON. Thank you, Mr. Rohrabacher. This is a great country, isn't it?

Dr. Ehlers, you can close us out.

Mr. EHLERS. Thank you very much, and thank you, Mr. Chairman, for holding this hearing and especially for putting together such a super panel. I really appreciate the testimony that was offered and the wisdom that all four of you have displayed.

I just want to make two points. Based on my educational career, which was 22 years long, the most important thing is to educate for the jobs of the future. Too often we tend to be educating for the jobs of the past or perhaps the present but we have to anticipate what the jobs of the future are going to be and educate accordingly. That is not easy but it has to be done.

Secondly, math and science education has to be done properly in the early elementary grades. If you really want someone to become

an engineer, that means they have to do well in math and science in elementary school. To the extent that they like it when they get to high school, they will take the advanced math and science courses there, and when they go to the university they will slip right into the program. Too often, and I learned this from my colleagues at the universities, too often someone who would make a good scientist or a good engineer was not excited by science in the early years, in high school took the easiest courses possible, then went to the university and said I would like to be an engineer or a physicist or whatever. They say oh, sure, we would love to have you do that but first of all you'll have to take two more years at the university in order to get up to speed with the math and science that you need. Well, obviously, very few of them are going to say well, yes, I would love to spend two more years here and spend another \$80,000 of my parents' money. They are just going to say well, okay, I will take something else. And so we really have to be farsighted enough to recognize the key role that the elementary schools will play in this as well.

Thank you very much. You were right on target and I really appreciate your testimony and your time and your wisdom. Thank you very much.

Chairman GORDON. Thank you, Dr. Ehlers.

Mr. Tonko, Mr. Carnahan, any final conclusions?

Mr. Hall is recognized.

Mr. HALL. Mr. Chairman, thank you. I had to go to Energy and Commerce and I had some other questions, but we have a reporter that is taking down everything and the rest of Congress will get to hear your answers and I will review that. I was just thinking back as I listened to my friend from California here back when I was on a church board, the word was that the Lord kept the preacher humble and the board kept him broke. Rohrabacher has the same effect on this committee. He is the last word of the rest of the story and he is a very good member of this committee.

I yield back my time and I thank this good panel.

Chairman GORDON. Thank you, Mr. Hall. I think Dr. Ehlers said it very well. This was a superb panel. We appreciate you altering your schedules. I know, Ms. Wince-Smith, you have to get going out of the country. Both your testimony and your presence was a very strong way to kick off this important reauthorization. We thank you. One thing I took away from this is that I need to talk to Mr. Rangel, Oberstar, Berman, Miller, Obey and Waxman this afternoon and see if they will share some of their jurisdiction, and we could really make some real progress there. Thank you.

The record will remain open for two weeks for additional statements from Members and answers to any follow-up questions Members may ask the witnesses. The witnesses are excused.

[Whereupon, at 12:19 p.m., the Committee was adjourned.]

Appendix:

ANSWERS TO POST-HEARING QUESTIONS

ANSWERS TO POST-HEARING QUESTIONS

Responses by John Castellani, President, Business Roundtable

Questions submitted by Representative Ralph M. Hall

Q1. As recommended in Mr. Donohue's testimony, this Committee should be "vigilant about duplication of funding and efforts among the Department of Education, the National Science Foundation, NASA, the Department of Energy, and other Federal agencies." This was a major concern of ours when this Committee considered ARPA-E. Likewise, we felt that some of the STEM programs established within DOE are repetitious of existing programs. Please share with us those programs that you consider to be duplicative in the current version of COMPETES or may have the potential for duplication in the reauthorization.

A1. Business Roundtable is concerned about Federal spending and ballooning budget deficits. We believe Congress has a responsibility to root out waste, inefficiency and duplication in Federal programs.

When it comes to STEM education, which represents a fundamental investment in future U.S. innovation capacity, a diversified portfolio of programs that address different STEM education needs and experiment with different ways of motivating students probably makes sense. Business Roundtable does not have the knowledge or expertise to render a judgment on every single Federal STEM education program but our impression is that the programs at different agencies operate in silos and are not well aligned.

Q2. Taking into consideration the current economic environment and the fact that we may need to make some tough funding decisions, are there any provisions in the current COMPETES Act that could be scaled back or that you feel are unnecessary? Are there programs that you feel are vital and must be preserved?

A2. Although America COMPETES programs were authorized in August 2007, they were not funded until early 2009. It is too soon for Business Roundtable to judge which provisions are least effective. We can say with confidence, however, that STEM education and funding for physical sciences and engineering research are the most vital elements of the Act. They are the building blocks of U.S. innovation and competitiveness.

Question submitted by Representative Daniel Lipinski

Q1. In response to a question asked by Congressman Garamendi, you referred to inefficiencies in the higher education system and stated that these inefficiencies would be unsustainable in the business sector. Could you elaborate on these comments or provide examples of such inefficiencies? Are there any specific steps you would suggest to eliminate them or to improve how our higher education system uses Federal money?

A1. Over the past three decades, higher education costs skyrocketed and tuition and fee increases dramatically exceeded the rate of inflation. Two-year public college costs more than quadrupled, and four-year public and private colleges saw costs increase 691 percent. Yet the number of associate degrees conferred increased by 70 percent and bachelor's degrees by 68 percent. Community colleges clearly are a better bargain.

If we are to meet the growing demand for a better educated and trained workforce, our institutions of higher education must find creative ways to do more with less. On-line learning is a promising approach that frees education from a physical plant. Some institutions are using flexible scheduling and experimenting with classes 24/7, offering options to earn course credits and degrees over shorter, more concentrated periods of time. Perhaps most important for Federal policy, incentives should be built into both institutional and student aid that reward timely completion of degrees and other credentials valued in the marketplace.

Question submitted by Representative Ben R. Lujan

Q1. Key components of Federal technology transfer policy are the Bayh-Dole and Stevenson-Wydler Acts passed 30 years ago. What is your assessment of these Acts on innovation and competitiveness of American companies? Also, after 30 years, what recommendations, if any, on how the implementation of these Acts could be improved given the current focus on innovation policy?

A1. The Bayh-Dole and Stevenson-Wydler Acts were important policy innovations that strengthened America's capacity to innovate. They remain important contributors to U.S. economic competitiveness. America's innovation systems could be further improved by speeding processing of patent applications, enacting reforms that reduce patent litigation and strengthening international intellectual property protection.

Question submitted by Representative Kathleen A. Dahlkemper

Q1. What types of skills do you expect bachelor, masters and Ph.D. level graduates to have when entering your workforce, beyond just content knowledge in a particular STEM field? Are our colleges and universities today providing students the training and opportunities they need to develop those skills? How can industry work more closely with colleges and universities to ensure that the students are being educated appropriately for today's workforce needs?

A1. Last December, Business Roundtable released the final recommendations from The Springboard Project—an independent commission it convened—to ensure that American workers thrive after the economy rebounds. While the commission found that the gap between worker skills and the needs of employers is widening, the skills gap is primarily an education gap as employers increasingly require postsecondary degrees beyond a high school diploma. In addition to content knowledge at the college and advanced degree levels, industry has worked closely with engineering and science departments to influence the curriculum and identify the need for written and oral communication skills, team problem solving and collaboration.

In terms of college and post-graduate preparation, many Business Roundtable companies also work directly with U.S. colleges and universities to sponsor scholarships and fellowships and offer workplace experience through internships and traineeships to help ensure that U.S. higher education remains relevant to the workplace.

Question submitted by Representative Judy Biggert

Q1. How have your companies reacted to the economic downturn in terms of investments in R&D and new technologies? How do your members balance the recognized value of R&D in driving long-term success with the pressures to improve short-term balance sheets by potentially cutting back on such investments?

A1. According to a report released last December by the Battelle Memorial Institute and *R&D Magazine*, private-sector R&D investments fell by an estimated 5.5 percent in 2009, compared to 2008. The same report, however, projects a robust recovery in industrial R&D spending in 2010. Battelle estimates that industrial R&D will account for nearly 65 percent of all R&D investment in the United States this year. Business Roundtable companies invested more than \$110 billion in R&D last year, nearly half the total private-sector investment in 2009. Despite the enormous pressure to reduce costs, Business Roundtable CEOs have maintained healthy R&D activities because they understand the competitive advantage conferred by in-house innovation. As the economy recovers and demand and revenues grow, R&D investments by Business Roundtable companies also will grow.

Questions submitted by Representative Brian P. Bilbray

Q1. The American COMPETES Act focuses on the much needed problem of under-investment of basic science research. However, many of the small biotech companies in my San Diego district are just as concerned with commercialization of technology. As Venture Capital money dries up, how can we best bridge this "valley of death." Do you think ideas such as proof of concept grants/programs would work? What about changes to the SBIR/STTR programs. What other changes do you think the Federal Government should consider in order to address this issue?

A1. The U.S. venture capital system remains the best in the world in identifying and promoting promising commercial innovation. No other country performs as well as the United States in terms of nurturing nascent technology companies. The U.S. venture capital sector was hit hard by last year's credit and liquidity crisis. For the better part of year, venture capital all but disappeared. As capital markets have recovered, so too has the venture capital market, but less rapidly than other markets.

Government can play a useful role in venture capital markets by reducing risk, which is what Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs are designed to help with, but government cannot replace private venture capital. U.S. venture capital's history of success rests, in part, on its ability to cut its losses and move on to new investments in the face of failure. Government has no such ability. The political pressure to continue funding underperforming enterprises would be too great to resist in many instances.

Q2. Overall Federal funding for basic research has been flat or declining on a real-dollar basis since fiscal year 2005. What implications does this trend have for the U.S. science enterprise?

A2. Flat or declining Federal research investments, particularly in physical sciences and engineering research, have been a serious drag on U.S. innovation for more than twenty years. Last year, however, witnessed a dramatic turn around with significant new research investments enacted in the American Recovery and Reinvestment Act (ARRA), which Business Roundtable endorsed. If last year's trend is maintained, it will have a significant, positive effect on the long-term economic competitiveness of the United States.

Q3. The America COMPETES Act established specific funding authorization levels for both NSF and the Dept. of Energy Office of Science—although appropriations for both agencies have not yet reached those recommended levels. Should the America COMPETES Act reauthorization establish revised specific funding levels for NSF and the DOE Office of Science? What are the advantages and disadvantages of Congress setting targeted funding levels?

A3. The Science and Technology Committee of the U.S. House of Representatives established important guidelines for Congress and the Administration in the America COMPETES Act and its authorization levels for Federal civilian science agencies. Those authorization levels led directly to the generous funding levels for basic research in ARRA and in the President's budget requests to Congress. The National Science Foundation and the Office of Science in the Department of Energy are two of the most important Federal agencies when it comes to investments that foster U.S. innovation and competitiveness. The Science and Technology Committee has knowledge and expertise related to how these agencies function that Congress and the Administration rely on. Specific authorization levels proved particularly valuable in the America COMPETES Act and likely would be valuable in any reauthorization.

Q4. NSF received a significant infusion of funds through the American Recovery and Reinvestment Act (ARRA). Are you concerned about what will happen to the NSF budget once the ARRA money has been spent? What should Congress do to sustain the momentum created by ARRA?

A4. Business Roundtable has consistently advocated for stable, long-term funding commitments for Federal investments in fundamental physical science and engineering research. While the Roundtable endorsed ARRA and was pleased to see Congress fund the research investment priorities embodied in the America COMPETES Act, we remain concerned about the long-term health of the U.S. science and technology enterprise. We are encouraged, however, by the President's Fiscal Year 2011 budget request for the National Science Foundation and other Federal civilian science agencies that sponsor physical science and engineering research. Congress can sustain momentum by reauthorizing the America COMPETES Act and appropriating funds for Federal science agencies consistent with the authorization levels specified in the Act.

Q5. According to 2010 Science and Engineering Indicators released by the National Science Board (NSB) last week, the Federal share of the Nation's research and development (R&D) funding was an estimated 26 percent in 2008—down from 30 percent in 2004. Does the fact that the Federal share of R&D funding is declining concern you? What is the impact of this declining funding trend?

A5. Business Roundtable has been concerned about the long-term decline in Federal R&D investments as a percentage of gross domestic product (GDP) for many years. Federal R&D spending is an investment in future economic growth and should track the overall size of the economy. ARRA included a significant short-term boost to Federal R&D spending and, as indicated in my answer to the previous question, Business Roundtable believes this momentum must be sustained.

The declining Federal share of national R&D investment is only a concern to the extent that it reflects stagnating Federal R&D budgets and a decline in Federal R&D relative to the size of the economy. Private-sector R&D investments have

grown over the last decade, both in absolute terms and relative to Federal investments. Increased private-sector R&D investments are a good thing. As I mentioned earlier in response to a question from another Committee member, Business Roundtable companies invested more than \$110 billion in R&D last year, which represented nearly half of all private-sector R&D investments in 2009.

In short, Business Roundtable believes that Federal R&D investments relative to GDP are a more meaningful indicator of U.S. innovation performance than the Federal share of R&D spending.

ANSWERS TO POST-HEARING QUESTIONS

Responses by Thomas J. Donohue, President and CEO, U.S. Chamber of Commerce

Questions submitted by Representative Ralph M. Hall

Q1. As recommended in Mr. Donohue's testimony, this Committee should be "vigilant about duplication of funding and efforts among the Department of Education, the National Science Foundation, NASA, the Department of Energy, and other Federal agencies." This was a major concern of ours when this Committee considered ARPA-E. Likewise, we felt that some of the STEM programs established within DOE are repetitious of existing programs. Please share with us those programs that you consider to be duplicative in the current version of COMPETES or may have the potential for duplication in the reauthorization.

A1. The U.S. Chamber of Commerce believes that every effort should be made to prevent Federal spending from resulting in massive budget deficits. Congress must be particularly vigilant to avoid duplication of effort or funding when it comes to Federal programs. The U.S. Chamber has not undertaken a comprehensive evaluation of all Federal STEM programs supported by the America COMPETES Act. Our concern is that the Federal agencies operating and funding programs have not optimized alignment thereby limiting the scale and lessons learned from the programs as well as limiting the impact of the available funds.

In relation to ARPA-E reauthorization, we believe that while there exists the very real potential for duplicative efforts between ARPA-E and the Department of Energy's (DOE) Office of Science, we believe such duplications are not inherently automatic. As such, we support adequate funding for ARPA-E as it provides a particular focus on deployable technologies that has historically not been fully met by the Office of Science, while at the same time we encourage diligent oversight by Congress and DOE to ensure funding of the two offices does not become duplicative.

Q2. Taking into consideration the current economic environment and the fact that we may need to make some tough funding decisions, are there any provisions in the current COMPETES Act that could be scaled back or that you feel are unnecessary? Are there programs that you feel are vital and must be preserved?

A2. As a result of the America COMPETES programs not receiving funding until early 2009, we believe that an insufficient amount of time has passed to ascertain program efficacy with any amount of certainty. With that in mind, we urge the committee to support STEM education and funding for physical sciences and engineering research. These are the programs that fuel U.S. innovation and preserve our competitiveness.

Question submitted by Representative Ben R. Lujan

Q1. Key components of Federal technology transfer policy are the Bayh-Dole and Stevenson-Wydler Acts passed 30 years ago. What is your assessment of these Acts on innovation and competitiveness of American companies? Also, after 30 years, what recommendations, if any, on how the implementation of these Acts could be improved given the current focus on innovation policy?

A1. The Bayh-Dole and Stevenson-Wydler Acts play a significant role in creating incentives for government contractors, universities and other beneficiaries of Federal agency support to commercialize their innovations thereby driving competitiveness. There are some key areas where improvements to the intellectual property environment could be made both domestically and abroad. This committee can play a critical role in bringing attention to these areas. The backlog of patents must be reduced by speeding up the processing of patent applications. Work must be done to enhance pro-IP positioning of the Organization for Economic Co-operation and Development (OECD) so that it advances research, policy positions, and other products that promote IP as key to innovation and creativity and calls for the protection of IP and the enforcement of IP rights globally.

Question submitted by Representative Kathleen A. Dahlkemper

Q1. What types of skills do you expect bachelor, masters and Ph.D. level graduates to have when entering your workforce, beyond just content knowledge in a particular STEM field? Are our colleges and universities today providing students the training and opportunities they need to develop those skills? How can indus-

try work more closely with colleges and universities to ensure that the students are being educated appropriately for today's workforce needs?

A1. The skills that are commonly referred to as 21st century skills are now required for success in the workplace for STEM and all other professionals. They can be summarized in four groups: critical thinking and problem solving, communication, collaboration, and creativity and innovation. These are the areas where U.S. secondary students begin to fall short on the international exams. Students in the United States fare less well when they are asked to apply knowledge that they possess to solve a problem or to explain a problem. This is one factor that has resulted in U.S. 15 year olds ranking 24th out of 29 participating OECD countries on the Math Literacy portion of the PISA exam. The lack of these skills persists through post-secondary education and into the workforce. Many of the U.S. Chamber's members work closely with colleges and universities from which they recruit employees to improve the programs offered by those institutions and the success rates of the students they prepare.

Question submitted by Representative Judy Biggert

Q1. How have your companies reacted to the economic downturn in terms of investments in R&D and new technologies? How do your members balance the recognized value of R&D in driving long-term success with the pressures to improve short-term balance sheets by potentially cutting back on such investments?

A1. There is insufficient data available to render a definitive response to this question at this time. Each company balances the short term and long term demands differently. Research and Development is essential and has beneficial effects over the long haul. Economic theory supports this analysis.

Questions submitted by Representative Brian P. Bilbray

Q1. The American COMPETES Act focuses on the much needed problem of under-investment of basic science research. However, many of the small biotech companies in my San Diego district are just as concerned with commercialization of technology. As Venture Capital money dries up, how can we best bridge this "valley of death." Do you think ideas such as proof of concept grants/programs would work? What about changes to the SBIR/STTR programs. What other changes do you think the Federal Government should consider in order to address this issue?

A1. The U.S. venture capital system is unparalleled. No other nation has a system as successful at identifying and developing new technology companies. The downturn in the economy had a negative effect on all markets and particularly the venture capital markets. While recovery has been slow, it is on the rise.

Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs can help to reduce risk which is an appropriate role for the Government. Flexibility, efficiency, agility, and resistance to political pressure when determining the length and level of investments account for the success of the U.S. venture capital system.

Within the energy sector we recognize that many nascent technologies find it extremely difficult to secure adequate capital to bridge the "valley of death" between development and deployment, hindering our pursuit of a more secure energy future. We strongly support the creation of an independent Federal entity empowered to provide concessionary financial products such as loans, loan guarantees, and risk insurance in support of new energy technology deployment. This entity would operate in a manner similar to the Export-Import bank, but focused on domestic deployment of new energy technologies.

Q2. Overall Federal funding for basic research has been flat or declining on a real-dollar basis since fiscal year 2005. What implications does this trend have for the U.S. science enterprise?

A2. Federal research investments have decreased in real dollars for the past 5 years. Many would argue that the trend started much earlier and that the United States has coasted on investments made as long as 50 years ago. Last year, the Chamber endorsed the American Recovery and Reinvestment Act (ARRA) which included significant new research investments. The passage of ARRA signified the recommitment of America to innovation through research and development. We believe that the R&D investments in ARRA will help us regain our lead in innovation among our global peers.

Q3. *The America COMPETES Act* established specific funding authorization levels for both NSF and the Dept. of Energy Office of Science—although appropriations for both agencies have not yet reached those recommended levels. Should the America COMPETES Act reauthorization establish revised specific funding levels for NSF and the DOE Office of Science? What are the advantages and disadvantages of Congress setting targeted funding levels?

A3. The funding recommendations set by the Science and Technology Committee of the U.S. House of Representatives for the National Science Foundation and the Office of Science in the Department of Energy translated into significant investments in these two agencies through ARRA and subsequent budget requests from the White House. With increased demand for government transparency and efficiency, the committee's funding recommendations will surely be valuable to the general public, Members of Congress, and the Administration in during the reauthorization process.

Q4. *NSF received a significant infusion of funds through the American Recovery and Reinvestment Act (ARRA)*. Are you concerned about what will happen to the NSF budget once the ARRA money has been spent? What should Congress do to sustain the momentum created by ARRA?

A4. The U.S. Chamber stated in our 2010 Policy Priorities that we will work to “promote ways to better value long-term investment, entrepreneurial risk taking, revolutionary research and development, and intangible assets.” We believe that the America COMPETES Act coupled with ARRA provided necessary investments and focus on the U.S. science and technology enterprise. Greater effort must now be placed by Congress on creating a sustainable the level of funds for the Federal agencies that are responsible for the bulk of science and engineering innovations. If America is serious about its competitiveness, we must reauthorize the America COMPETES Act and appropriate the funds required to accomplish the goals set forth in the Act.

Q5. *According to 2010 Science and Engineering Indicators* released by the National Science Board (NSB) last week, the Federal share of the nation's research and development (R&D) funding was an estimated 26 percent in 2008—down from 30 percent in 2004. Does the fact that the Federal share of R&D funding is declining concern you? What is the impact of this declining funding trend?

A5. The Chamber is concerned about the downward trend in Federal R&D investments, however, over the same period, from 2004–08, private sector investments increased as a share of GDP. While we are not fully aware yet how much private sector investment in R&D may have declined over the recent economic downturn, it is important to note that ARRA is providing a significant boost in both Federal and private sector R&D that may help put the country back on the right track. In the long term, we believe that Federal R&D spending should be considered in the context of the larger economy as a percentage of GDP. Our challenge going forward will be to increase and stabilize the level of investments needed to keep America's competitiveness strong.

ANSWERS TO POST-HEARING QUESTIONS

Responses by Governor John Engler, President and CEO, National Association of Manufacturers

Questions submitted by Chairman Bart Gordon

Q1. Both of you touch on the importance of strong manufacturing programs in the Federal Government. One area that we hope to include in a COMPETES Act reauthorization is a comprehensive manufacturing research and development program across agencies. We want to take a look at what is currently being done and what we might be able to do better. We'd be very interested in your specific thoughts on this effort and any concrete suggestions you might have.

A1. Chairman Gordon, I want to thank you once again for the opportunity to offer the National Association of Manufacturers' (NAM) thoughts on the reauthorization of the America COMPETES Act.

A comprehensive cross-agency strategy to quantify, assess and coordinate all federally-funded R&D is an excellent idea. Just as the Comprehensive National Cybersecurity Initiative is working to unify Federal agencies' approaches to protecting our national cybersecurity interests, a similar effort should be aimed at protecting the future of our national economic security, which relies on the ability of American manufacturing to innovate. Federally funded R&D is the seed corn that will produce the next harvest of benefits for our economy, with much of the bounty coming from the manufacturing sector. Such an effort will enable policymakers to determine what Federal R&D efforts are successful, which efforts are duplicative, and where our finite resources can best be used.

As the Committee contemplates this strategy, it is our recommendation that any efforts keep in mind and coordinate with private sector efforts. U.S. manufacturers perform half (49 percent) of all R&D in the nation—or roughly equal to the combined R&D activities of the rest of the private sector, universities and colleges, Federal Government non-profits and federally-funded R&D centers. Manufacturers, however, who claim the bulk of all R&D credits (71 percent), saw the cost of performing domestic R&D increase at the beginning of 2010 due to the 14th expiration of the Federal R&D tax credit since it was created in 1981. Any such Congressional effort to create a cross-agency R&D program should make part of its focus supporting a permanent, strengthened R&D tax credit, as R&D is the fuel for innovation that drives new product development and increased productivity, two key factors necessary for growth in manufacturing.

Questions submitted by Representative Ralph M. Hall

Q1. As recommended in Mr. Donohue's testimony, this Committee should be "vigilant about duplication of fielding and efforts among the Department of Education, the National Science Foundation, NASA, the Department of Energy, and other Federal agencies." This was a major concern of ours when this Committee considered ARPA-E. Likewise, we felt that some of the STEM programs established within DOE are repetitious of existing programs. Please share with us those programs that you consider to be duplicative in the current version of COMPETES or may have the potential for duplication in the reauthorization.

A1. With regards to STEM education, there may be programs that should be combined, but just as important, existing programs should be streamlined and refined to better meet the needs of students. It is possible to create better value within existing Departments of Labor and Education programs without creating new programs. For example, by looking at specific programs such as Trade Adjustment Assistance (TAA), the Federal Perkins Loans Program and the Workforce Investment Act (WIA), we can create priorities that improve education by linking it to employer needs. Looking at these programs to make them more effective before creating new programs will streamline government process.

Q2. Taking into consideration the current economic environment and the fact that we may need to make some tough funding decisions, are there any provisions in the current COMPETES Act that could be scaled back or that you feel are unnecessary? Are there programs that you feel are vital and must be preserved?

A2. The P-16 program outlined in the America COMPETES Act takes a step toward integrating the skills needed by employers and education systems by calling

for education alignments with the private sector. Driving students toward advanced degrees in STEM areas is critical for competitive success; however, so is continuing education for those who may not follow the traditional degree path.

Question submitted by Representative Ben R. Luján

Q1. Key components of Federal technology transfer policy are the Bayh-Dole and Stevenson-Wydler Acts passed 30 years ago. What is your assessment of these Acts on innovation and competitiveness of American companies? Also, after 30 years, what recommendations, if any, on how the implementation of these Acts could be improved given the current focus on innovation policy?

A1. The NAM recognizes the critical success the Bayh-Dole Act represents: a major effort on behalf of the Federal Government to aid the rapid commercialization of scientific discovery. At this time, however, the NAM has not developed policy recommendations on how the Bayh-Dole Act can be improved to strengthen our nation's innovation policy.

Question submitted by Representative Kathleen A. Dahlkemper

Q1. What types of skills do you expect bachelor, masters and Ph.D. level graduates to have when entering your workforce, beyond just content knowledge in a particular STEM field? Are our colleges and universities today providing students the training and opportunities they need to develop those skills? How can industry work more closely with colleges and universities to ensure that the students are being educated appropriately for today's workforce needs?

A1. Nearly every day I hear from employers who have available positions but cannot find qualified candidates to fill the slots. It is imperative that students have the applicable knowledge necessary to succeed in the workforce. Too many times students graduate, not just from graduate school and college, but also from high school, with skills that cannot be practically applied in the workforce. Basic and advanced STEM education should be directly related to the skills and competencies required by employers. For example, the NAM-Endorsed Skills Certification system is an organized system of nationally portable, industry-recognized credentials implemented in coordination with community colleges to educate students in the skills relevant to the demands of advanced manufacturing. By making programs such as these a priority within Perkins, TAA and WIA, we can align the needs of students with the needs of employers.

Question submitted by Representative Gary C. Peters

Q1. You mention in your written testimony that the MEP program, despite receiving an increase in funding in FY10, still faces an uncertain future. Can you expand on that? What do you hear from your membership regarding the future of the program?

A1. The Manufacturing Extension Partnership (MEP) has for years been a critical program for small- and medium-sized manufacturers, helping them streamline plant operations and improve their bottom lines. Despite the MEP's benefits to American manufacturing, its budget has been relatively flat since its inception in 1999 and imperiled more than once due to cost-cutting efforts. For instance, the proposed budget for FY 2004 would have cut its funding from \$106 million to \$12.6 million. Most recently in 2008, an attempt was made to cut its funding even more—a full \$87 million below the level needed to maintain its existing services, to a proposed budget of only \$4 million.

We are heartened to see that the Obama Administration has reversed this trend, especially with the increased funding the MEP received through the American Recovery and Reinvestment Act. The MEP is very important to NAM members as it provides small- and medium-sized manufacturers affordable access to technical expertise so that they can create more high-paying manufacturing jobs—despite today's daunting economic cost pressures. We will work with Congress and the Administration to ensure that the MEP continues to get the attention—and funding—it deserves.

Q2. I have introduced a bill with Rep. Ehlers to reduce the participant matching requirement in the MEP program to 50%, and give the Secretary of Commerce the authority to further reduce the match where necessary. Would this change help

manufacturers continue to access the program in the face of state budget cuts and difficult economic times?

A2. As you note, this is an increasingly difficult time not only for manufacturers, but for state governments as well, especially as they face deeper and deeper budget cuts. H.R. 4394, which authorizes the Secretary of Commerce to reduce the matching requirement for MEP participants, will go a long way to ensure that states continue to fund MEP centers and that smaller manufacturers will be able to take advantage of this critical program.

Under the current MEP cost-sharing ratio, the Federal Government covers one-third of the cost, with the states taking up the remaining two-thirds. This is the highest cost-sharing ratio in the Dept. of Commerce, according to its staff. Because of the economic downturn, 23 state MEP centers reported a decrease or elimination of state funding. Those that remain are now forced to shift the cost-share burden to small manufacturers who are unlikely to be able to afford increased contributions due to the current economic conditions. The end result is that in many areas, the availability of MEP services is in jeopardy.

H.R. 4394 relieves the states of a large part of this burden, by allowing the Federal Government and the states to share the costs equally so that local MEP centers can focus on making mission-based decisions, such as increasing program management capabilities. Reducing the state matching requirement from 66 percent to 50 percent will reduce the pressure on state budgets, allowing small manufacturers continued access to critical MEP services and helping them decrease costs, increase sales and create much-needed jobs.

Question submitted by Representative Judy Biggert

Q1. How have your companies reacted to the economic downturn in terms of investments in R&D and new technologies? How do your members balance the recognized value of R&D in driving long-term success with the pressures to improve short-term balance sheets by potentially cutting back on such investments?

A1. The economic downturn has hurt every sector across the board, not the least of which are manufacturers. Many manufacturers have been forced to hunker down to weather the economic uncertainty, trying to make due with less. Manufacturers understand, however, that investment in R&D and new technologies has to be made if they are to have new products, services and processes in place for when the economy rebounds. An important factor in deciding on how much to invest in R&D is how that investment will be treated on their balance sheet. Key to that decision is whether their investments will be protected by a strengthened, permanent Federal R&D tax credit.

To that point, I'd like to take this opportunity to thank you for your long-time, continued support of a strengthened, permanent Federal R&D tax credit and your co-sponsorship of bipartisan legislation. H.R. 422, sponsored by Representatives Meeks and Brady. This bill will help keep R&D jobs in the United States. For manufacturers, who claim 71 percent of all R&D tax credits, this tax incentive helps reduce the cost of R&D done in the United States by lowering the cost of keeping and hiring R&D employees. Only R&D performed in the United States qualifies for the credit.

Also, R&D is inherently risky and, for manufacturers, R&D projects typically span 5 to 10 years. A strengthened, permanent credit would assure companies that the credit will be available during the life of an R&D project. More than 500,000 jobs would be created within a decade if the R&D credit were strengthened and made permanent according to the Milken Institute report released January 2010.¹

Questions submitted by Representative Brian P. Bilbray

Q1. The American COMPETES Act focuses on the much needed problem of under-investment of basic science research. However, many of the small biotech companies in my San Diego district are just as concerned with commercialization of technology. As Venture Capital money dries up, how can we best bridge this "valley of death." Do you think ideas such as proof of concept grants/programs would work? What about changes to the SBIR/STTR programs. What other changes do you think the Federal Government should consider in order to address this issue?

¹*Jobs for America: Investments and Policies for Economic Growth and Competitiveness*, Milken Institute, January 2010. www.milkeninstitute.org/jobsforamerica.

A1. The Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs represent a critical effort on behalf of the Federal Government in which to aid the rapid commercialization of scientific discovery, especially in the biotechnology field. At this time, however, the NAM has not developed policy recommendations on how the SBIR/STTR programs can be improved to strengthen our nation's innovation policy.

Q2. *Overall Federal funding for basic research has been flat or declining on a real-dollar basis since fiscal year 2005. What implications does this trend have for the U.S. science enterprise?*

A2. The fact that overall Federal funding for basic research has been flat or declining for the past five years poses a significant issue for the future of innovation in America. Even when one incorporates the doubling of Federal R&D dollars in the America COMPETES Act into the equation, Federal efforts are *just* keeping at a constant pace—not very heartening news when China increased its R&D investment to \$52.4 billion in 2008 (about 1.49 percent of GDP, up from \$29.4 billion in 2005). In that same period, the U.S. spent \$116.5 billion on federally funded R&D, facilities and fixed equipment—or 2.62 percent of our GDP.² As I mentioned in my written testimony, this does not include R&D expenses at labs owned by foreign companies. If China continues R&D spending of about 1.5 percent of GDP for 2009, its research will total about \$72 billion.³ However, China has one of the fastest-growing research budgets in the world, and by 2020 the government's goal is to invest 2.5 percent of GDP annually in research, which will rank China third in the world in terms of total annual investment.⁴ As the R&D innovation gap between the U.S. and China shrinks, so does our global competitive advantage.

The future of American innovation requires a commitment to investing in R&D, from both the public and private sector. The fortunes of the U.S. manufacturing and science sectors are closely entwined, as successes in one area usually benefit the other, with the end beneficiary being American workers and consumers. We commend Congress for having the foresight in creating the America COMPETES Act to ensure that successes in innovation continue to benefit our global competitiveness. As I mentioned, the private sector has a role to play as well, and the Federal R&D tax credit is a proven tool for spurring R&D jobs in the United States; the credit's incentive value would be enhanced if a permanent, strengthened credit were enacted into law.

Q3. *The America COMPETES Act established specific funding authorization levels for both NSF and the Dept. of Energy Office of Science—although appropriations for both agencies have not yet reached those recommended levels. Should the America COMPETES Act reauthorization establish revised specific funding levels for NSF and the DoE Office of Science? What are the advantages and disadvantages of Congress setting targeted funding levels?*

A3. As pointed out by your previous question, even when adjusted to a real-dollar basis, Federal funding for basic R&D has largely been flat. As noted in the recent Congressional Research Service (CRS) report, *Federal Funding and Development Funding: FY 2010*,⁵ increasing the amount spent on basic R&D will be dependent upon two large issues: how much the Federal Government can afford in light of increasing pressure on discretionary spending, and how those funds will be prioritized. As our economic security and global competitiveness are dependent upon how much we as a nation are willing to do to invest in our future success, Congress may very well have to revise spending levels for the NSF and the DOE Office of Science.

That answer may also be impacted by how our emerging competitors—China, India, Russia—ramp up investment in their future. Although we may lead the world in funding basic R&D, we need to be cognizant of how our competitors close the innovation gap. We are confident, however, that the ultimate answer on how much we need to revise spending levels will be revealed as the Committee continues its inquiry into the reauthorization of the America COMPETES Act through the many hearings scheduled through the remaining Congressional session.

Q4. *NSF received a significant infusion of funds through the American Recovery and Reinvestment Act (ARRA). Are you concerned about what will happen to the*

²“Federal R&D Support Shows Little Change in 2008,” National Science Foundation, *Info Brief* September 2009.

³“Engineering & Research,” Plunkett Research, website visited January 14, 2010.

⁴*Ibid.*

⁵U.S. Congressional Research Service. *Federal Research and Development Funding: FY 2010* (R40710; Jan. 12, 2010), by John F. Sargent, Jr.

NSF budget once the ARRA money has been spent? What should Congress do to sustain the momentum created by ARRA?

A4. Increased funding for basic R&D at the NSF, along with the DOE's Office of Science and the NIST, has been a key priority for manufacturers because the work they do leads to advances in areas critical to American manufacturers, such as energy efficiency, advanced materials design, nanotechnology and more powerful computer chips. The funds appropriated to the NSF through ARRA increased the NSF's FY 2009 funding by approximately \$3 billion and were critical in ensuring that the funding amounts promised by the America COMPETES Act were fulfilled. While we applauded this outcome, the goal set out in America COMPETES—to double Federal basic R&D funding for key research agencies such as the NSF by 2012—may be put in jeopardy by the demands of the appropriations process.

For instance, on June 18, 2009, the House Committee on Appropriations passed H.R. 2847, the Commerce, Justice, Science, and Related Agencies (CJS) Appropriations Bill, 2010.⁶ The bill would have provided a total of \$6.937 billion for the NSF in FY 2010, \$108.5 million below the President's request. The Senate Appropriations Committee reported the bill on June 25, 2009,⁷ and the Senate passed the bill on November 5, 2009. The Senate measure would have provided \$6.917 billion for the NSF, \$19.7 million below the House passed bill and \$128.2 million below the Administration's request. Finally, on December 16, 2009, the President signed into law the Consolidated Appropriations Act of 2010.⁸ The omnibus act includes funding for six appropriations for FY 2010, including the CJS appropriation, providing a total of \$6.927 billion for the NSF, approximately \$118.0 million below the President's request.

While the appropriations process is never as fast or as uncomplicated as many would hope, it is our concern that funding of critical basic R&D programs such as those at the NSF will be lost in the shuffle as Congressional appropriators wrestle with an uncertain economy, attempt to heed cries for constrained spending, and work to comply with the new pay-as-you-go rules. Perhaps the best way to sustain the momentum created by ARRA is to highlight the direct successes achieved by increased R&D funding to each agency, including jobs and opportunities created. For example, the above-mentioned CRS report highlights that on May 27, 2009, the NSF announced its first major award made with funding from ARRA—for construction of the Alaska Region Research Vessel (\$148.0 million). This dual-purpose vessel has been designed to operate as both an icebreaker and a research ship, has the ability to carry as many as 500 people, stay at sea for as many as 300 days a year, and has an operational life span of 30 years. The NSF states that, "The three-year construction phase of the project will support 4,350 total jobs, 750 directly at the shipyard and as many as 3,600 in the broader economy."⁹ The award announcement noted that the NSF intends to ensure that the vessel will be built in a U.S. shipyard. It is this very type of good news—jobs and opportunities for American workers—that will bring continued support for the federally-funded R&D envisioned in the America COMPETES Act.

Q5. *According to 2010 Science and Engineering Indicators* released by the National Science Board (NSB) last week, the Federal share of the nation's research and development (R&D) funding was an estimated 26 percent in 2008—down from 30 percent in 2004. Does the fact that the Federal share of R&D funding is declining concern you? What is the impact of this declining funding trend?

A5. This concerns the NAM because its impact, as noted above, is to put our nation at a competitive disadvantage with our global competition as they increase their spending. Of course, it should also be noted that the business community has greatly expanded its share of R&D spending over the past five years, which would impact the numbers in the above report. Further, only recently has the government picked up its pace in funding federal R&D, as highlighted above with regards to fulfilling the promise of the America COMPETES Act in doubling Federal funding for key research agencies by 2012.

⁶H.Rept. 111–149 (2009).

⁷S.Rept. 111–34 (2009).

⁸P.L. 111–117 (2009).

⁹National Science Foundation, "NSF Announces First Major Award Under American Recovery and Reinvestment Act to the Alaska Region Research Vessel (ARRV)," press release, May 27, 2009.

Additional Note:

During the hearing, Representative Rohrabacher asked me whether the NAM had opposed the elimination of treble damages in H.R. 1908, the Patent Reform Act of 2007. The NAM sent a letter to Judiciary Chairman Conyers and Ranking Member Smith on May 18, 2007, commenting on a number of aspects of H.R. 1908. In that letter, we raised concerns with proposed changes to how damages for an infringement would be calculated. However, with his reference to treble damages, I assume Representative Rohrabacher was referring to the issue of willful infringement, which provides extra-compensatory damages as a form of punitive damages when a defendant knowingly infringed on a patent the defendant knew was owned by the plaintiff. In our letter, we did mention our support for the provision in H.R. 1908 that would reform the *standard* by which a court would determine whether a defendant willfully infringed on a plaintiff's patent rights. It is our understanding that the treble damages would still be available as compensation for a finding of willful patent infringement. I have attached a copy of the letter for your files.

ANSWERS TO POST-HEARING QUESTIONS

Responses by Deborah L. Wince-Smith, President and CEO, Council on Competitiveness

Questions submitted by Chairman Bart Gordon

Q1. Both of you touch on the importance of strong manufacturing programs in the Federal Government. One area that we hope to include in a COMPETES Act reauthorization is a comprehensive manufacturing research and development program across agencies. We want to take a look at what is, currently being done and what we might be able to do better. We'd be very interested in your specific thoughts on this effort and any concrete suggestions you might have.

A1. Greater focus on research and development of manufacturing processes is a critical component to any overall manufacturing agenda. Not only can innovation bring new ideas to market, but innovative solution to how those ideas are brought to market are equally as important. Further, in the Council on Competitiveness' report Innovate America, we highlighted a collaborative program in upstate New York where multiple companies, the state and the Federal Government partnered to create an early stage manufacturing facility that enables companies small and large to demonstrate a product's viability before proceeding to full-scale manufacturing. This concept is worth further consideration.

Questions submitted by Representative Ralph M. Hall

Q1. As recommended in Mr. Donohue's testimony, this Committee should be "vigilant about duplication of funding and efforts among the Department of Education, the National Science Foundation, NASA, the Department of Energy, and other Federal agencies." This was a major concern of ours when this Committee considered ARPA-E. Likewise, we felt that some of the STEM programs established within DOE are repetitious of existing programs. Please share with us those programs that you consider to be duplicative in the current version of COMPETES or may have the potential for duplication in the reauthorization.

A1. The Council on Competitiveness shares the concerns expressed by Congressman Hall regarding unnecessary duplication in STEM education programs, but unfortunately I am not able to cite specific programs we believe should be eliminated or strengthened. The Council has argued strenuously for greater focus on STEM education, as it is the foundation for job skills required by the growth sectors of our economy.

Q2. Taking into consideration the current economic environment and the fact that we may need to make some tough funding decisions, are there any provisions in the current COMPETES Act that could be scaled back or that you feel are unnecessary? Are there programs that you feel are vital and must be preserved?

A2. As I detailed in my testimony, there are a number of critical provisions in the America COMPETES Act that must be a part of any reauthorization. These include:

1. The Council on Competitiveness strongly urged the creation of a President's Council on Innovation and the legislation included such a provision, yet the reality has not matched the intent. What became clear as we sought the input and advice from leaders within government and the private sector was that the government's innovation policy was fragmented, poorly coordinated and often running at cross purposes between agencies and departments. We would urge a fresh look at this provision.
2. Predictable and steady support for long-term research across Federal agencies including the National Science Foundation, DOE Office of Science, NIST and NASA is a vital first step toward an innovation-based economy. America COMPETES made great strides in this area. Any authorization should continue this commitment.
3. Support for the National Institutes of Standards and Technology's (NIST) work in the area of manufacturing is critical to many small and medium sized manufacturers. These companies are key job producers in America's economy. NIST has made strides toward embracing innovation in manufacturing and this trend is worthy of the Committee and Congress's support.
4. Strengthening STEM education through programs at the Department of Education, the National Science Foundation and other R&D agencies and de-

partments is important. I realize there are multiple programs that touch upon this issue across the Federal Government and I will not try to analyze each one separately here. I only urge the Committee to recognize that almost every career today requires some grasp of or skill in science, technology, engineering and mathematics and we must ensure that all Americans have a solid grounding in these fields.

As with any major piece of legislation, a number of provisions were added to the bill as it moved through the Congress. Many of these were valuable additions, but many also were never funded including, as I understand it, several reports. I would urge the Committee to focus of actions rather than reports and on solutions rather than meetings or summits, which inevitably focus on the problems.

Question submitted by Representative Ben R. Luján

Q1. Key components of Federal technology transfer policy are the Bayh-Dole and Stevenson-Wydler Acts passed 30 years ago. What is your assessment of these Acts on innovation and competitiveness of American companies? Also, after 30 years, what recommendations, if any, on how the implementation of these Acts could be improved given the current focus on innovation policy?

A1. While far from the being the perfect solutions, these Acts have helped move ideas from the laboratory to the marketplace. The greatest ongoing challenge I hear about in conversations with CEOs and university leaders is the widely disparate approach taken to intellectual property. Every university, every company tackles this challenge differently (often differently within departments and/or divisions). I'm not sure this is a problem that can be solved by Federal Government action.

Question submitted by Representative Kathleen A. Dahlkemper

Q1. What types of skills do you expect bachelor, masters and Ph.D. level graduates to have when entering your workforce, beyond just content knowledge in a particular STEM field? Are our colleges and universities today providing students the training and opportunities they need to develop those skills? How can industry work more closely with colleges and universities to ensure that the students are being educated appropriately for today's workforce needs?

A1. The best answer I can give is to reiterate an example I highlighted during the question period at the hearing—the U.S. Naval Academy graduates all its students with an engineering degree, but that is just the baseline. They also have language skills, communications or business degrees, history, government, and writing etc. . . . Success in the job market for American students will not be determined by a single discipline, but at the intersection of disciplines—with a strong foundation in STEM.

Question submitted by Representative Judy Biggert

Q1. How have your companies reacted to the economic downturn in terms of investments in R&D and new technologies? How do your members balance the recognized value of R&D in driving long-term success with the pressures to improve short-term balance sheets by potentially cutting back on such investments?

A1. It's impossible to generalize across all companies as to their reaction to the recession. However, I will say that the leading edge companies are the ones that maintained their investment in R&D during the downturn. They will be the ones that emerge stronger and better positioned to capture market share in the months ahead.

Questions submitted by Representative Brian P. Bilbray

Q1. The American COMPETES Act focuses on the much needed problem of under-investment of basic science research. However, many of the small biotech companies in my San Diego district are just as concerned with commercialization of technology. As Venture Capital money dries up, how can we best bridge this "valley of death." Do you think ideas such as proof of concept grants/programs would work? What about changes to the SBIR/STTR programs. What other changes do you think the Federal Government should consider in order to address this issue?

A1. Augmenting current project funding models is a key factor in bridging the “valley of death.” Increasing access to funding for later stages of product development is essential in getting products to market. As I indicated in my testimony, many foreign investment groups are stepping in to fund late-stage projects that have stalled in the absence of domestic funding sources. In these cases, the foreign investors are reaping the benefits of both the initial U.S. investment as well as the revenues generated from a product in the market. Our approach to supporting investors needs to be more comprehensive and focus on all stages of development. Doing so will certainly help put more American technologies in the market, and do it faster.

With regard to SBIR, I would strongly recommend expanding that program to cover stage III funding, so we do not lose the potential job creation on investments we have already made.

Q2. *Overall Federal funding for basic research has been flat or declining on a real-dollar basis since fiscal year 2005. What implications does this trend have for the U.S. science enterprise?*

A2. America’s economic viability is inextricably linked with our capacity as a nation to develop and commercialize innovative goods and services for consumption at home and abroad. Federal dollars are a catalyzing force in the development of the groundbreaking technologies which allow America to remain competitive against foreign rivals. Declining Federal funding means fewer high-risk, high-high reward, long-term projects will receive funding at a time when it is needed the most. Without Federal support, America’s science enterprises can and will be overtaken by foreign competitors whose governments are willing to invest heavily in R&D. Investing Federal dollars in American science enterprises is an investment in the nation’s economy and will help our nation remain the global leader in innovation and technology development.

Q3. *The America COMPETES Act established specific funding authorization levels for both NSF and the Dept. of Energy Office of Science—although appropriations for both agencies have not yet reached those recommended levels. Should the America COMPETES Act reauthorization establish revised specific funding levels for NSF and the DOE Office of Science? What are the advantages and disadvantages of Congress setting targeted funding levels?*

A3. I would strongly recommend that the levels be maintained and that supporters inside and outside of Congress work to bring the Appropriations funding up to those authorized levels. Long term research requires stable predictable funding levels.

Q4. *NSF received a significant infusion of funds through the American Recovery and Reinvestment Act (ARRA). Are you concerned about what will happen to the NSF budget once the ARRA money has been spent? What should Congress do to sustain the momentum created by ARRA?*

A4. The best thing Congress can do to maintain the momentum created by ARRA, is to fund these agencies with steady predictable increases as authorized in America COMPETES.

Q5. *According to 2010 Science and Engineering Indicators released by the National Science Board (NSB) last week, the Federal share of the nation’s research and development (R&D) funding was an estimated 26 percent in 2008—down from 30 percent in 2004. Does the fact that the Federal share of R&D funding is declining concern you? What is the impact of this declining funding trend?*

A5. R&D is a key innovation pillar and encouraging the development of technologies, supporting nascent industries and funding groundbreaking research through R&D investment is integral to America’s innovation strategy. Trends showing a reduction in Federal R&D funding are indeed alarming. Federal R&D dollars have historically supported high-risk, far-horizon investments, the variety unlikely to see the same level of support from the private sector. Diminishing Federal R&D investment will directly impact America’s ability to retain its competitive advantage in the global arena, and adversely impact the development of advanced marketable technologies and services.