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**Executive Office of the President of the United States**  
to the  
**Committee on Energy and Commerce**  
**Subcommittee on Commerce, Trade and Consumer Protection**  
**United States House of Representatives**  
on  
**Advanced Manufacturing**  
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Chairman Rush, Ranking Member Whitfield, and Members of the Subcommittee, it is my distinct privilege to be here with you today to discuss the Obama Administration's Strategy for Revitalizing American Manufacturing.

President Obama understands the importance of innovation for sustainable growth and quality jobs. On September 21<sup>st</sup>, 2009, he released his *Strategy for American Innovation* that identified three critical roles for the Federal Government: to invest in the building blocks of innovation; to create the right environment for private sector investment and competitive markets; and to serve as a catalyst for breakthroughs related to national priorities such as clean energy, high-quality health care, and other "grand challenges" of the 21st century. The strategy recognizes that a strong U.S. manufacturing sector is needed to make progress toward all three goals. On December 19<sup>th</sup>, 2009, the President released "A Framework for Revitalizing American Manufacturing" that identified seven principles to strengthen our manufacturing sector.

In my capacity as Assistant to the President, Chief Technology Officer, and Associate Director for Technology in the Office of Science and Technology Policy, my mission is to harness the power and potential of technology, data, and innovation to transform the Nation's economy and to improve the lives of everyday Americans. The Administration envisions an economy in which jobs are more plentiful, American firms are more competitive, American manufacturing is robust and exports of high tech products and services far exceed imports.

For the record, I will not be commenting on H.R. 4692, but rather my testimony will provide a perspective on the challenges the United States faces in manufacturing, the important role that innovation and Advanced Manufacturing play in meeting these challenges, and the Obama Administration's strong commitment to implement appropriate Federal policies to promote a strong, innovative U.S. manufacturing sector.

### **Manufacturing Challenges**

The United States continues to lead the world in the production of manufactured goods, accounting for nearly 20 percent of global manufacturing output. The National Association of Manufacturers estimates that an increase in manufacturing creates more economic activity than a similar

increase in any other sector – every \$1.00 in manufactured goods generates an additional \$1.37 of economic activity. Manufactured goods represent 69 percent of our exports and manufacturing firms perform almost two-thirds of private sector R&D, the highest R&D intensity as a percentage of sales of any major industrial sector.

Manufacturing jobs have long been seen as the foundation of the “American dream” and an entryway into the middle class. Total hourly compensation in the manufacturing sector averages more than \$32.00, approximately 20 percent higher than average compensation in service industries. The manufacturing sector also boasts high and fast-growing productivity. Between 1987 and 2009, manufacturing productivity increased at a rate of 3.4 percent annually, as compared to only 2.3 percent for non-farm business as a whole.

In recent years, the size of U.S. manufacturing has declined – in its share of GDP, employment numbers, relative R&D spending, and innovation performance. Employment in the U.S. manufacturing sector has gone from 17.6 million jobs in 1998 to just 11.7 million currently. Even the trade balance in high-technology products – historically a bastion of U.S. strength – shifted from surplus to deficit for the first time in 2002 and has remained in deficit since then. At the same time, China’s trade position in high-technology products shifted to surplus beginning in 2001, and increased from less than \$13 billion in 2003 to almost \$130 billion in 2008.

The situation facing American manufacturing has become an issue in the current economic crisis. Existing manufacturing enterprises are under severe competitive pressure from both outsourcing and global competition. While innovation is clearly seen as the driver of economic prosperity, creating new products and processes from these innovations is crucial if the economic value of innovation is to be realized.

A recent benchmarking exercise by the Information Technology and Innovation Foundation (ITIF) measured U.S. and European nations’ innovation capacity against the rest of the world; the U.S. economy ranked sixth of 40 economies. But the exercise found that the U.S. ranked last in terms of “improvements in innovation capacity,” meaning the U.S. is relying on historical strengths and is in danger of sliding down future rankings. A recent Hollings Manufacturing Extension Partnership (MEP) Advisory Board report *Innovation and Product Development in the 21st Century* from the Department of Commerce contains similar findings.

These shifts are as important to the evolution of existing manufacturing enterprises as to emerging fields, such as nano-manufacturing, bio-manufacturing and next generation semiconductors. They also are critical for the nation’s educational institutions, which must prepare tomorrow’s workforce at a new and technologically sophisticated level.

### **The Need for Innovation**

Innovation typically begins from scientific research that creates new opportunities for technological change. That basic research lays the foundation for the development of new products, services, or processes. But it does not end there. To create value, a new idea must be implemented through translational research and eventual incorporation into innovative products and services.

Successful innovations will diffuse throughout an economy and across the world, impacting various sectors and sometimes even creating new ones. And if the innovation is successful, then it can scale up to create new markets.

Ideas often fail before they make it through the full chain. But those that do succeed can create value and jobs while improving people's lives. For societies to prosper—both as producers of goods and services as well as consumers of them—innovations need to flourish and progress along this chain. And here, government has a fundamental role to play.

The government should:

- **Remove barriers** that inhibit the rapid movement of U.S. industry toward advanced manufacturing;
- **Accelerate** R&D, innovation, and commercialization in the U.S. manufacturing sector; and
- **Better equip** the U.S. workforce with the new knowledge and skills necessary to work at world-class levels of advanced manufacturing.

### **Administration's Policies and Initiatives to support Manufacturing**

The Obama Administration's December 19<sup>th</sup>, 2009 report on "A Framework for Revitalizing American Manufacturing" identified key facts and assumptions that form the basis of a sound and comprehensive manufacturing policy. These include cost drivers that influence manufacturing location choices, environment impact, and productivity.

In order to understand the appropriate role for government to support manufacturing and capture its positive social impacts, we must first identify each cost driver in the manufacturing process beginning with raw materials and ending at the point of sale of finished goods. These cost drivers include labor, technology and business practices, equipment, location, transportation, access to markets, regulation and taxation.

The manufacturing sector is undergoing transformative change. We can help foster and facilitate this change and ensure that workers and communities thrive in the midst of this change if we take certain critical actions. Past manufacturing strategies have largely failed. Two different views have dominated these past approaches. One view was that manufacturing industries needed to be protected and insulated. Not only was this approach ineffective but it was also counterproductive. An alternative view was *laissez-faire*, cutting critical research and support programs and hoping the market will take care of problems. This approach has contributed to the steep job losses over the last decade but more importantly threatens to rob us of the potential for greater innovation over future decades. An alternative to these two poles is a strategy that recognizes that change is inherent in the economy and necessary for productivity growth. Evidence-based policy can help foster and channel this change and ensure that workers and communities can thrive in the midst of it.

The key to success lies in American workers, businesses and entrepreneurs – but the federal government can play a supporting role in providing a new foundation for American manufacturing. The right role for government is to optimize its own interaction with each key cost driver of the manufacturing

process.

The Obama Administration's policies and initiatives that support manufacturing can be broken into seven parts that draw on the lessons from analyzing the manufacturing process and government's role in each cost driver. We must:

1. Provide workers with the opportunity to obtain the skills necessary to be highly productive.
2. Invest in the creation of new technologies and business practices.
3. Develop stable and efficient capital markets for business investment.
4. Help communities and workers transition to a better future.
5. Invest in an advanced transportation infrastructure.
6. Ensure market access and a level playing field
7. Improve the general business climate, especially for manufacturing.

Some of these principles directly address the President's Innovation Strategy released in September 2009 "A Strategy for American Innovation: Driving Towards Sustainable Growth and Quality Jobs". I would like to highlight Administration efforts in two of these areas.

### **Investing in the Creation of New Technologies and Business Practices**

The key manufacturing growth areas in the 21st century will be driven by new technologies and new areas of consumer demand. The most successful areas will be combinations of the two, such as using new technologies to satisfy the increasing demand for clean energy. In other areas, a new innovation like nanotechnology has the promise to transform production processes and consumer products for everything from traditionally high-tech products like computers to less obvious sources of innovation and growth like sunscreen and paint. New business practices and expertise will also be key drivers of competitiveness going forward.

There is often a debate about the right type of government support for advanced technologies. The *laissez-faire* approach is premised on the belief that private industry will simply develop the best innovations and technologies. This, however, ignores three critical facts. First, it is well established that the private sector often under-invests in the most basic research since it cannot capture all the benefits from such research. Second, spillovers exist between sub-industries. For instance, innovations in nanotechnologies are being applied to a wide range of areas. Third, coordination failures exist in which no individual makes an investment because it will not be profitable unless a number of others make similar investments. This is a problem that the United States is addressing in the electric car industry, for example, with a wide range of initiatives. Inventions from the telegraph to the jet engine, the microwave oven and the Internet did not happen simply because of private sector incentives.

On the other hand, policymakers must recognize that government has a poor track record in picking winners and losers. This is in part due to the limited ability of the government to predict the future, but it is also because such exercises are inevitably distorted by the political process. The new approach to manufacturing policy gets around these twin problems by recognizing that the government has a vital role to play in basic research, that it can help address the coordination problems and that it can

use innovative techniques to encourage economic development while avoiding picking winners and losers – for example, the relatively new policy tools of prizes and reverse auctions could be used to jump start technological advances and/or production in new manufacturing industries.

The Obama Administration is supporting new technologies in several key ways.

Basic research is fundamental to the economic growth of any society. The United States devotes less than three percent of GDP to research and development – a ratio that is exceeded by a number of countries including Japan, Sweden, Switzerland, South Korea, Iceland and Israel. The American Recovery and Reinvestment Act already included the largest increase in research and development in our history, a total of more than \$18 billion. Increases must be sustained and linked to America’s manufacturing success. The Obama Administration will:

**Double the R&D budgets of key science agencies.** President Obama has proposed to double the research budgets of three key science agencies (the National Science Foundation, the Department of Energy's Office of Science and the National Institute of Standards and Technology’s laboratory programs).

**Improve coordination of manufacturing-related R&D.** The National Science and Technology Council will develop a strategy for coordinating the federal government’s investments in research with the goal of establishing U.S. leadership in advanced manufacturing technologies. Some of the examples of this research include:

- Nanomanufacturing and the application of nanotechnology to traditional manufacturing industries;
- Creating the foundation for a “bio-economy” that uses biotechnology to make “green” chemicals;
- Developing advanced robotics technologies that allows the U.S. to retain manufacturing and respond rapidly to new products and changes in consumer demand;
- Integrating manufactured goods and information technology to create “cyberphysical systems” that have greater adaptability, autonomy, efficiency, functionality, reliability, safety and usability.

**Explore new options to stimulate innovations and technological breakthroughs.** The Administration will explore the possibility of using prizes and reverse auctions as a complement to grants, tax credits and other mechanisms currently used to spur innovative technologies. The advantages of using prizes and reverse auctions are that success is rewarded directly on an objective, demonstrated basis, and federal money is used to leverage private sector resources in a targeted manner. These approaches could target many key areas identified as likely manufacturing-related wealth and job creators of the future, including batteries, nanotechnology, clean energy and bioengineering. The prizes and reverse auctions could work together, with prizes incentivizing the necessary breakthroughs in basic research and reverse auctions supporting early stage of commercialization and production.

**Make the research & experimentation tax credit permanent.** To give companies the certainty they need to make long-term research and experimentation investments in the U.S., the Administration’s 2011 budget includes the full cost of making the R&E credit permanent in future years. Making this tax

credit permanent will provide businesses with the greater confidence they need to initiate new research projects that will improve productivity, raise standards of living, and increase our competitiveness.

**Spur innovation in manufacturing by Increasing the Technology Innovation Program (TIP).** The TIP supports, promotes and accelerates innovation in the United States through high-risk, high-reward research in areas of critical national need. One current area of focus is research on advanced manufacturing processes and materials. Awards in this area have the potential to spur new and much-needed capabilities in the manufacturing sector – whether in production techniques, material sciences or cutting edge design options. The Obama Administration is committed to the success of the program and the catalyzing of innovation.

**Pursue structural reforms that support innovation and production.** Various structural and regulatory reforms have the potential to support innovation and increase production. The Obama Administration will explore a range of such reforms, including:

- Public-private partnerships that can generate mutually beneficial arrangements between major businesses and localities. Manufacturing Infrastructure and other similar projects are good examples of such partnerships.
- Use of the federal government’s coordinating abilities to overcome information problems and match innovators and markets. A manufacturer’s competitiveness is often dependent on the speed with which the company finds new markets and adopts new technologies, innovative product concepts, and improved operational and management practices. There are often information failures in the market that prevent some learning and exchange of ideas that would help manufacturers grow. The government can help overcome such information failures and help to spread new and innovative business practices.

**Protect intellectual property rights.** Intellectual property is crucial for developing new technologies. We must ensure that intellectual property is protected in foreign markets and promote greater cooperation on international standards that allow our technologies to compete everywhere. The Administration is committed to ensuring that the United States Patent and Trademark Office has the resources, authority and flexibility to administer the patent system effectively and issue high-quality patents on innovative intellectual property, while rejecting claims that do not merit patent protection.

### **Developing stable and efficient capital markets for business investment**

In addition to stabilizing the broader financial system and providing capital assistance to small businesses and companies that compete globally, the Obama Administration is committed to expanding access to financing for manufacturers facing these tough economic conditions. Most notably, the Administration’s combination of loans, grants, and tax credits for renewable energy manufacturing will help the United States regain its position as the world leader in manufacturing clean energy equipment. Programs include:

**1603 cash grants in lieu of tax credits:** When the Recovery Act passed, many renewable energy projects had been halted as few developers had the ability to utilize the Production Tax Credit (PTC). Some forecasts expected the industry to shrink 25 to 50 percent. ARRA allows renewable energy

generation projects to receive a 30 percent cash grant in lieu of the Production Tax Credit. The program has already supported over 1GW of renewable energy projects.

**DOE 1703 and 1705 loan guarantees:** DOE loan guarantees can back financing for factories that make wind turbines, solar panels, energy efficient windows, and other clean energy equipment.

**Section 48C manufacturing tax credit:** The Section 48C Advanced Energy Manufacturing Tax Credit supports the building and equipping of new, expanded, or retooled factories that manufacture the products needed to power the green economy. The program covers a wide array of clean energy technologies, including renewable energy, energy efficiency, advanced transportation, and advanced transmission. The Recovery Act included \$2.3 billion in tax credits that will support over \$7.5 billion in total capital investment. This program has generated far more interest than anticipated. On December 16 2009, the Administration announced its support for expanding the program by up to \$5 billion. This funding will go to shovel ready projects that will create tens of thousands of new construction and manufacturing jobs and continue America's emerging leadership in manufacturing the clean energy products of the future.

### **Other Innovation-based Manufacturing Initiatives**

Recognizing the need for long-term and sustained investments in R&D, President Obama has pledged to double the funding for three key science agencies: the National Science Foundation (NSF), the laboratories of the National Institute of Standards and Technology (NIST), and the Department of Energy's (DOE) Office of Science.

The Obama Administration is working to increase the impact of this investment by providing greater support for university commercialization efforts, for potentially transformative research, for multidisciplinary research, and for scientists and engineers at the beginning of their careers. For example, NSF's 2011 budget proposes to double support for the Partnerships for Innovation program, which will help universities move ideas from the lab to the marketplace.

Other innovation-based manufacturing initiatives proposed in the President's 2011 budget include:

- NSF Cyber-physical Systems: Additional \$1.6M to better integrate information technology into manufactured goods. This is part of a \$20M increase for Advanced Manufacturing to fund a new "bio-economy" effort aimed at building the basic research foundations for future biotechnology industries in areas such as "green" chemicals and other new biologically based materials.
- NSF Nano Manufacturing: Additional \$10M targeted at NSF grant support for nano-manufacturing and the application of nano-scale science and engineering to traditional manufacturing industries.
- Additional funding was recommended for the Commerce department to support NIST's Technology Innovation Program (TIP) and Hollings Manufacturing Extension Partnership (MEP) program.

### **Recovery Act**

I would like to take this opportunity to note the impact the Recovery Act is having on U.S.

manufacturing. American Recovery and Reinvestment Act (ARRA) investments not only lay the foundation for the clean energy economy of the future, but some could have a significant impact on the domestic manufacturing infrastructure. Examples include:

- Over \$2 billion to support domestic manufacturing of advanced batteries and other components of Advanced Vehicles and Fuels Technologies.
- \$4.5 billion investment for Smart Grid technologies will help expand our manufacturing base of companies that can produce the smart meters, smart appliances, synchrophasors, smart transformers and other components for smart grid systems in the United States and around the world - representing a significant and growing export opportunity for our country and new jobs for American workers.
- \$2.3 billion in 48C Advanced Energy Manufacturing tax credits that will partner with private investment to increase our capacity to manufacture wind turbines, solar panels, electric vehicles, and other clean energy components domestically.

### **Computational Modeling and Simulation**

I would also like to highlight our efforts in a specific area of advanced manufacturing: computational modeling and simulation. Quality, cost, flexibility and time to market are key elements of manufacturing competitiveness. It has been widely recognized that Computational Modeling and Simulation tools could significantly reduce the need for physical prototype testing thereby reducing the product development time, costs and improve quality. These tools also accelerate discovery and innovation thereby allowing designers, manufacturers, and regulators to make better decisions in shorter time frames. However, modeling and simulation tools are not exploited as routinely as they should in industrial product or process design, innovation and manufacturing, and the technology has not penetrated far beyond the top of the supply chain. The reasons behind limited adoption of these tools include lack of understanding of value proposition by SMEs, affordability of software and hardware, availability of technical experts, verification, standards, certification and reliability of software tools including their ability to capture realism of the physical world. As the Co-chair of the National Science and Technology Council's (NSTC) Committee on Technology, I recently stood up a Fast Track interagency subcommittee to identify gaps and challenges in computational modeling and simulation and make recommendations.

### **The Way Forward**

Thanks to President Obama's leadership, the Administration has taken large strides in developing and implementing an ambitious innovation agenda. The President has appointed Mr. Ron Bloom as the Senior Counselor for Manufacturing Policy within the White House, signaling the high priority placed on manufacturing and leadership needed to develop a coherent, overarching advanced manufacturing strategy and to oversee its implementation across the Federal Government.

For the United States to maintain leadership in advanced manufacturing, the Federal government needs an ability to formulate policies and develop programs across the Federal Government in a coherent effective manner. Established mechanisms in the Executive Branch, such as the National Science and Technology Council (NSTC), can provide coordination and even elements of overall strategy. With

current Federal manufacturing R&D programs highly diffused and totaling less than \$500 million, there appears to be a need for focused and concerted Federal support to providing such investments in manufacturing R&D to fully materialize the benefits of emerging technologies. OSTP has been actively convening multiple interagency meetings to discuss gaps in Federal programs in advanced manufacturing and opportunities to strengthen existing industries and creation of new industries. OSTP is fully committed to continue such activities in support of the President's Innovation Strategy and the principles outlined in the Administration's Framework for Revitalizing American Manufacturing.

The Administration is working with a wide range of stakeholders to identify the most promising ideas for implementing and further refining the Administration's innovation strategy. There are active inter-agency working groups on issues such as prizes and challenges, regional innovation clusters, research commercialization, spectrum reform, broadband, open government, and standards. The National Science and Technology Council is leading multi-agency research initiatives in dozens of critical areas such as aeronautics, green buildings, nanotechnology, robotics, and information technology.

Through the President's Council of Advisors on Science and Technology (PCAST), the Administration is able to gain invaluable insight from the Nation's leading scientists, engineers and innovators on Advanced Manufacturing. The PCAST subcommittee on Advanced Manufacturing plans to release a report in the coming months outlining their findings and recommendations.

In order to revitalize our manufacturing sector we must continue our focus on building blocks of innovation – basic research, translational research, public-private partnerships, tools that enhance manufacturing competitiveness and productivity.

The United States is still the land of the future. We have held that honor since this continent was discovered by a daring act of exploration more than 500 years ago. We have earned it anew with each passing generation because America's scientists, entrepreneurs and public officials have understood the importance of applying the power of American curiosity and ingenuity to the biggest economic and societal challenges.

I welcome any questions that the Committee may have.