

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

HEARING CHARTER

*The Future of Manufacturing: What is the Role of the Federal Government in Supporting
Innovation by U.S. Manufacturers?*

Wednesday, March 17, 2010

10:00 a.m. – 12:00 p.m.

2318 Rayburn House Office Building

1. PURPOSE

On Wednesday, March 17, 2010, the House Committee on Science and Technology will hold a hearing to receive testimony on the need for U.S. manufacturers to adopt innovative technologies and processes in order to remain globally competitive, and to determine the appropriate role for the Federal Government in supporting efforts by U.S. manufacturers to innovate.

2. WITNESSES

- **Dr. Susan Smyth**, Director of Manufacturing, GM R & D, and Chief Scientist for Manufacturing, General Motors Company
- **Dr. Len Sauers**, Vice President, Global Sustainability, Procter & Gamble
- **Mr. Debtosh Chakrabarti**, President and Chief Operating Officer, PMC Group Inc.
- **Dr. Mark Tuominen**, Director, National Nanomanufacturing Network
- **Mr. Wayne Crews**, Vice President for Policy and Director of Technology Studies, Competitive Enterprise Institute

3. BACKGROUND

The manufacturing sector plays a critical role in the U.S. economy. According to the Manufacturing Institute, in 2008, the manufacturing sector generated \$1.64 trillion worth of goods and, if it were a country by itself, would have ranked as the eighth largest economy in the world.¹ The manufacturing sector accounted for nearly 57 percent of total U.S. exports in 2008, and employed nearly 12 million people last year.²

¹ *The Facts About Modern Manufacturing, 8th Edition* (Manufacturing Institute, 2009)

² *The Facts About Modern Manufacturing, 8th Edition*

However, manufacturing is no longer as dominant a sector of the U.S. economy as it has been in the past. In 2008, manufacturing represented 12 percent of GDP, which is a significant decline from nearly 30 percent in the early 1950s.³ In addition, between 2000 and 2007, the U.S. global market share of manufactured exports fell from 19 percent to 14 percent. During that same period, the Chinese share of global exports rose from 7 percent to 17 percent.⁴ In recent years, several key reports have argued that innovation – both in terms of the processes being used and the products being produced - is one key to preserving, and perhaps even growing, the manufacturing sector in the U.S.

- In its recent annual report entitled *Innovation and Product Development in the 21st Century*, the Manufacturing Extension Partnership Advisory Committee included a recommendation to manufacturers to “innovate constantly to adapt to economic and technological changes.” The Advisory Committee noted that leading manufacturing firms continue to innovate their way through economic and technological shocks and disruptions, and even use them to their advantage.⁵
- The Interagency Working Group on Manufacturing R & D made the following observation in *Manufacturing the Future: Federal Priorities for Manufacturing R & D*: “There is strong consensus in industry, academia, and government that the future competitiveness of U.S. manufacturing – and all that it underpins – will be determined, in large part, by research, innovation, and how quickly firms and industries can apply and incorporate new technologies into high value-added products and high-efficiency processes.”⁶
- In *The Innovation Imperative in Manufacturing: How the United States Can Restore Its Edge*, the Boston Consulting Group and the Manufacturing Institute at the National Association of Manufacturers concluded: “With high-quality inexpensive products flooding the market from every corner of the globe, competing on cost alone is a losing battle for most U.S.-based manufacturers...To stay in the game, companies in the United States must differentiate themselves through innovation: new products and services, new ways of working, new ways of going to market.”⁷

³ *Innovation and Product Development in the 21st Century* (Hollings Manufacturing Extension Partnership Advisory Board, February 2010)

⁴ *The Facts About Modern Manufacturing, 8th Edition*

⁵ *Innovation and Product Development in the 21st Century*

⁶ *Manufacturing the Future: Federal Priorities for Manufacturing R & D* (Interagency Working Group on Manufacturing R & D, Committee on Technology, National Science and Technology Council, March 2008)

⁷ *The Innovation Imperative in Manufacturing: How the United States Can Restore Its Edge* (The Boston Consulting Group & The Manufacturing Institute, March 2009)

4. OVERVIEW

National Science Foundation

The National Science Foundation (NSF) supports fundamental manufacturing research. This work is done primarily through the Division of Civil, Mechanical, and Manufacturing Innovation (CMMI) in the Engineering Directorate. The budget request for CMMI for Fiscal Year 2011 is \$206.5 million, an increase of 9.8 percent over the Fiscal Year 2010 enacted level.

The Division is divided into four program clusters, including an Advanced Manufacturing cluster. The cluster supports fundamental research leading to transformative advances in manufacturing technologies in the following areas:

- The *Manufacturing and Construction Machines and Equipment Program* supports fundamental research leading to improved machines and applications for manufacturing.
- The *Materials Processing and Manufacturing Program* supports fundamental research on the interrelationship of materials processing, structure, performance and process control. Analytical, experimental, and numerical studies are supported covering processing methods such as molding, forging, casting, welding, hydroforming, composite layup, and other materials processing approaches.
- The *Manufacturing Enterprise Systems Program* supports research on design, planning, and control of operations in manufacturing enterprises. Research is supported that impacts the analytical and computational techniques relevant to extended operations and that offer the prospect of implementable solutions.
- The *Nanomanufacturing Program* supports research and education on manufacturing at the nanoscale, and the transfer of research results in nanoscience and nanotechnology to industrial applications.

NSF supports four Nano Science and Engineering Centers that focus on nanomanufacturing: the Center for Hierarchical Manufacturing at the University of Massachusetts, the Center for Scalable and Integrated Nanomanufacturing at the University of California at Berkeley, the Center for High-Rate Nanomanufacturing at Northeastern, and the Center for Nano-Chemical-Electrical-Mechanical Manufacturing Systems at the University of Illinois at Urbana-Champaign.

NSF also supports the National Nanomanufacturing Network, which includes the four Nano Science and Engineering Centers and other academic, government, and industry partners. The Network is focused on facilitating and expediting the transition of

nanotechnologies from core research and breakthroughs in the laboratory to production manufacturing.

Finally, NSF hosts and sponsors workshops on manufacturing. For example, in 2009, NSF hosted workshops on energy manufacturing, additive manufacturing, and nanomanufacturing.

National Institute of Standards and Technology

Manufacturing Engineering Laboratory

Through its Manufacturing Engineering Laboratory (MEL), the National Institute of Standards and Technology (NIST) promotes innovation and the competitiveness of U.S. manufacturing through measurement science, measurement services, and technical contributions to standards. MEL has a budget of approximately \$43 million and a staff of 250 scientists and engineers, support personnel, craftsmen, technicians, and visiting scientists.

MEL is comprised of the following five divisions:

- The *Precision Engineering Division* conducts research in dimensional measurements, develops new measurement methods, provides measurement services, develops national and international artifact and documentary standards, and disseminates the resulting technology and length-based standards.
- The *Manufacturing Metrology Division* develops methods, models, sensors, and data to improve metrology, machines, and processes and provides services in mechanical metrology, machine metrology, process metrology, and sensor integration.
- The *Intelligent Systems Division* develops measurement and interoperability standards to enhance manufacturing robotics and automation equipment and the underlying industrial control systems.
- The *Manufacturing Systems Integration Division* develops and applies measurements and standards that advance information-based manufacturing technology.
- The *Fabrication Technology Division* provides instrument and specialized fabrication support for NIST researchers and serves as a testbed for many NIST/MEL programs

MEL also hosts workshops on manufacturing. For example, last year, MEL hosted workshops entitled “National Workshop on Challenges to Innovation in Advanced Manufacturing: Industry Drivers and R & D Needs” and “Workshop on Sustainable Manufacturing: Metrics, Standards, and Infrastructure”.

Manufacturing Extension Partnership

The Manufacturing Extension Partnership (MEP) program at NIST is a network of 59 centers

located in every State and Puerto Rico, providing a range of services to small and medium-sized manufacturers. The MEP centers advise businesses in a variety of areas, including lean manufacturing techniques. The Fiscal Year 2011 budget request for MEP includes a request for \$4.64 million to expedite and facilitate adoption of technological innovations by smaller U.S. manufacturers, especially clean technologies and processes that improve manufacturers' competitive position.

Technology Innovation Program

The Technology Innovation Program (TIP) at NIST was created in 2007 through the *America COMPETES Act* (P.L. 110-69). Its purpose is to support, promote, and accelerate innovation in the United States by funding high-risk, high-reward research in areas of critical need. In Fiscal Year 2009, manufacturing was one of two areas of critical national need for which TIP proposals were solicited. The TIP manufacturing solicitation emphasized: (1) process scale-up, integration, and design for advanced materials; and (2) predictive modeling for advanced materials and materials processing. TIP announced more than \$40 million in funding for manufacturing-related projects in Fiscal Year 2009.

Small Business Innovation Research and Small Business Technology Transfer

Executive Order 13329 (“Encouraging Innovation in Manufacturing”) was signed on February 24, 2004. It ordered the head of each executive branch department or agency with one or more Small Business Innovation Research (SBIR) programs or one or more Small Business Technology Transfer (STTR) programs to give high priority within such programs to manufacturing-related research and development to advance innovation in manufacturing.

In Fiscal Year 2009, about 100 of the 320 SBIR/STTR awards made at NSF had a major manufacturing innovation component. At the same time, in Fiscal Year 2009, more than 40% of SBIR/STTR awards at NIST had implications for manufacturing.

Sustainable Manufacturing

There are several Federal Government programs focused on sustainable manufacturing, also known as green manufacturing. The Department of Commerce defines sustainable manufacturing as “the creation of manufactured products that use processes that are non-polluting, conserve energy and natural resources, and are economically sound and safe for employees, communities, and consumers.”⁸

NIST's ***Manufacturing Engineering Lab*** conducts research in the area of green manufacturing. In fact, in its Fiscal Year 2011 budget request, NIST is requesting \$10 million in additional funding (for a total of \$16.4 million) for Green Manufacturing and Construction programs. According to the budget request, the funding will be used in part to develop an information

⁸ *How Does Commerce define Sustainable Manufacturing?*
(http://www.ita.doc.gov/competitiveness/sustainablemanufacturing/how_doc_defines_SM.asp.)

infrastructure, based on open standards, to communicate critical sustainability information efficiently among suppliers, customers, and regulators and to identify and disseminate best-practice methods, processes, and assessment tools for sustainable manufacturing in key industrial sectors.

At the Department of Energy, the Office of Energy Efficiency and Renewable Energy's **Industrial Technologies Program** partners with U.S. industry to carry out research, development, and demonstration of next-generation manufacturing technologies to reduce the use of energy by the U.S. industrial sector. The program supports research and development of new energy efficient technologies, supports commercialization of emerging technologies, and provides plants with access to proven technologies, energy assessments, software tools and other resources.

The budget request for Fiscal Year 2011 for the Industrial Technologies Program is \$100 million, a \$4 million increase over the Fiscal Year 2010 enacted level. The request includes \$10 million in funding for a new Manufacturing Energy Systems program focused on enhancing the competitiveness of America's manufacturers through the rapid innovation of new products and processes that significantly reduce manufacturing energy intensity and carbon emissions. According to the budget request, the program will be anchored at two premier universities and will serve as knowledge development and dissemination centers organized around distinct manufacturing areas with critical technical needs.

There are also several multi-agency efforts focused on sustainable manufacturing. These include the **Green Suppliers Network**, which is a collaborative venture among industry, the Environmental Protection Agency, and NIST's Manufacturing Extension Partnership. The program works with large manufacturers to engage their small- and medium-sized suppliers in low-cost technical reviews that focus on process improvement and waste minimization. The technical reviews, which are conducted by NIST, combine "lean and clean" manufacturing techniques to assist manufacturers in increasing energy efficiency, identifying cost-saving opportunities, and optimizing resources to eliminate waste within their manufacturing processes.

In addition, five Federal agencies – NIST (through the Manufacturing Extension Partnership), the Department of Energy (through the Industrial Technologies Program), the Environmental Protection Agency, the Department of Labor, and the Small Business Administration – participate in the **E3: Economy, Energy and Environment** program. Federal and local resources are combined to conduct assessments and gap analyses of company manufacturing processes, the results of which are used to develop comprehensive improvement plans on behalf of and in collaboration with the participating communities. The goals of the program, which operates under the umbrella of the Green Suppliers Network, include making manufacturing plants more energy efficient and cost effective; reducing the environmental impact of manufacturing plants through green manufacturing practices and improvements; improving regional economies by retaining jobs in more competitive companies and positioning them for growth and job creation

in emerging green industries; and assisting manufacturers in growing and succeeding in a sustainable business environment.

Coordination of Federal Manufacturing R & D

In January of 2004, the Department of Commerce released a report entitled *Manufacturing in America: A Comprehensive Strategy to Address the Challenges to U.S. Manufacturers*. One of the report's recommendations was the establishment of an interagency working group within the National Science and Technology Council (NSTC) to serve as a forum for developing consensus and resolving issues associated with manufacturing research and development policy, programs, and budget guidance and direction. Shortly thereafter, the Interagency Working Group (IWG) on Manufacturing Research and Development was established under the NSTC with the chartered goal of identifying and integrating requirements, conducting joint program planning, and developing joint strategies for the manufacturing research and development programs conducted by the Federal Government.

In March of 2008, the IWG produced a report entitled *Manufacturing the Future: Federal Priorities for Manufacturing R & D*, which identified three technology areas as areas of opportunity for Federal manufacturing research and development: manufacturing r & d for hydrogen technologies, nanomanufacturing, and intelligent and integrated manufacturing.

The charter for the IWG expired in March of 2009. Since the expiration of its charter, the IWG has not been active as a formal entity within the NSTC.

Administration's Framework for Revitalizing American Manufacturing

In December of 2009, the Executive Office of the President released *A Framework for Revitalizing American Manufacturing*. The Framework included seven areas of focus, with a commitment to take specific actions in each area. One of the framework's areas of focus is "invest[ment] in the creation of new technologies and business practices." Action items relating to this area of focus include:

- Doubling r & d budgets of key science agencies;
- Improving coordination of manufacturing-related r & d;
- Exploring new options to stimulate innovations and technological breakthroughs, such as prizes and reverse auctions;
- Making the research and experimentation tax credit permanent;
- Spurring innovation in manufacturing by increasing the Technology Innovation Program;
- Pursuing structural reforms that support innovation and production, such as public-private partnerships, providing anti-trust waivers for certain types of private cooperation, and using the Federal Government's coordinating abilities to overcome information problems and match innovators and markets;
- Protecting intellectual property rights;

- Doubling the Manufacturing Extension Partnership;
- Streamlining and enhancing delivery of government services to business; and
- Creating an Office of Innovation and Entrepreneurship and a National Advisory Council on Innovation in the Department of Commerce

Other areas of focus in the framework included: (1) providing workers with the opportunity to obtain the skills necessary to be highly productive; (2) developing stable and efficient capital markets for business investment; (3) helping communities and workers transition to a better future; (4) investing in an advanced transportation infrastructure; (5) ensuring market access and a level playing field; and (6) improving the business climate.

5. OVERARCHING QUESTIONS

- Are the Federal Government's current manufacturing research and development programs sufficient?
- Are there areas of research and development related to manufacturing that are not being addressed by the Federal government that should be addressed?
- What is the current role of the manufacturing industry in shaping the Federal manufacturing research and development agenda? Are Federal program focused on manufacturing research and development responsive to the needs of the manufacturing industry? If not, why not?
- Are the technologies and processes developed through Federally-funded manufacturing research and development programs being utilized by manufacturers? If not, why not?
- Are Federal programs focused on manufacturing research and development duplicative? If so, is there a need for better coordination and prioritization of Federal manufacturing research and development?
- Broadly speaking, what obstacles currently exist to manufacturers adopting innovative technologies and processes? Is there anything more that the Federal government should be doing, or could be doing, to help manufacturers adopt these technologies and processes?