

Testimony of

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Agencies

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Chairman Mollohan, Ranking Member Wolf, and members of the Subcommittee thank you for the opportunity to appear before you today to present the President's Fiscal Year 2011 budget request for the National Institute of Standards and Technology (NIST). This budget reflects the important role that NIST plays as part of President Obama's Plan for Science and Innovation. It also reflects how NIST's expertise fits squarely in the middle of key Administration priorities by making critical investments in key areas that will help preserve our nation's economic security.

The President's FY 2011 budget request for NIST is \$918.9 million, a 7.3 percent increase over the FY 2010 appropriations for the agency. The budget maintains the President's commitment to double the NIST laboratory budget by 2017, and to support and enhance our world leadership in the physical sciences and technology. The FY2011 request includes 10 laboratory-related initiatives totaling \$69.4 million for the Scientific and Technical Research and Services (STRS) account. The initiatives, detailed below, address critical measurement and standards challenges in manufacturing, advanced alternative energies, cybersecurity, the Smart Grid and a number of other critical issues.

The FY2011 request for our programs under the Industrial Technology Services (ITS) account includes an additional \$4.6 million above base in support for the Hollings Manufacturing Extension Partnership (MEP) that will continue to deliver new services to America's manufacturers such as tools to help stimulate adoption of green and sustainable manufacturing processes and support market diversification efforts. The request for the Technology Innovation Program (TIP) includes an increase of \$10 million to stimulate the development of game-changing new technologies that will address critical national needs and foster the development of new industries. These increases will allow NIST to increase its support for small manufacturers and continue funding high-risk, high-reward research, both of which will ultimately enable the creation of the types of high-wage jobs necessary for a strong and vibrant economy. The request also includes \$66.1 million above base in funds for the Construction of Research Facilities (CRF) appropriation to continue renovations of NIST's Boulder campus and to provide for increased maintenance of all NIST facilities to ensure that NIST has 21st century facilities in which to conduct the world-class research for which NIST is well-known.

NIST Supporting Innovation for the 21st Century Economy

Today, the Nation is facing significant economic challenges. But as this Subcommittee is aware, investments in science and technology are the foundation for the innovations and technological breakthroughs that will be key to our Nation's long-term economic growth and prosperity. As such, NIST's mission is more important than ever. Today, the NIST Laboratories address increasingly complex measurement challenges. For example, NIST develops measurements focusing on the very small—nanotechnology devices—and the very large—skyscrapers, and develops methods for characterizing everything from strands of DNA for forensic testing, to the performance of walk-through metal detectors. Working closely with U.S. industry and academia, NIST plays a central role in advancing and maintaining this technology support system which helps enable innovations and future technologies that lead to the jobs of the future. Several recent trends have highlighted the urgent need for expanded investment in this

technology support system, and by extension on the need for increased investment in NIST programs.

In the area of manufacturing, U.S. industry faces relentless competition that has trimmed the nation's share of global manufacturing output from 25 percent in 2000 to about 20 percent today. To reap the economic benefits of our ability to innovate, our nation's manufacturing sector must be able to renew itself by adopting new technology and growing into new markets. The Nation's more than 335,000 manufacturing plants must respond quickly and effectively to an ever-changing mix of requirements, risks, and opportunities, from new regulations to rising energy costs to emerging technologies and markets. The revitalization of the U.S. manufacturing base is critical to driving innovation and job creation in the future and will play a major role in building an economy that can help raise the standard of living for all Americans.¹

NIST's FY2011 budget request specifically targets these challenges with critical support for manufacturing in a number of areas including: advanced manufacturing capabilities necessary to capitalize on advances in nanotechnology and to enable rapid prototyping and manufacture of multiple high technology components; measurements to enable the efficient manufacture and regulation of biological drugs; and the measurement and data tools to support sustainable manufacturing practices.

Newly emerging technologies such as an electric-power Smart Grid and national health care information systems promise to transform our society and revitalize the U.S. economy. To be effective the many interconnected components in these systems must be fully interoperable, to allow information to be exchanged and used seamlessly across the system. Interoperability is not easy to achieve in these complex systems. NIST has deep experience and technical expertise in this field, and is helping to establish a framework of standards and related test protocols, and conformity assessment requirements to ensure seamless, end-to-end interoperability for both of these technologies. As a respected and trusted technical partner NIST is uniquely positioned to bring together stakeholders from industry, government, academia and standards development organizations to establish consensus-based interoperability standards and conformity tests. The President's budget request for NIST will support continued efforts in these critical areas as well as provide the infrastructure necessary to address other emerging interoperability challenges.

Another major challenge facing the nation is in the area of cybersecurity. Cybersecurity is vital to the economic and national security interests of the United States. In addition to enabling more than \$200 billion in annual e-commerce, interconnected networks of computers are essential for life-critical functions such as air traffic control and electric power distribution. Our nation's computers face ever-increasing threats from malicious individuals, organizations, and nation states. Effective computer security tools are often too complex for most administrators to understand and use. This allows many attacks to succeed, causing significant damage and undermining confidence in vital commercial and public information systems. The result is a large, direct economic impact -- estimates show that Americans lose billions of dollars each year to cyber crime.

¹ Executive Office of the President, *A Framework for Revitalizing American Manufacturing*, Dec. 2009.

NIST is responsible for cybersecurity research, development of federal cybersecurity standards, establishment of methods and metrics for determining the effectiveness of security controls, and providing technical support to public and private sector implementation of security standards and controls. An example of how NIST is supporting advances in secure IT is conducting research and developing voluntary consensus documentary standards for cryptography practices to safeguard the confidentiality and integrity of information and systems. This budget request will strengthen NIST's contribution to the development and promulgation of effective and usable cybersecurity systems.

Developing clean energy technologies that provide reliable, carbon neutral energy sources has become a top priority of the nation. Rapid progress will depend on innovations from many quarters, both private and public. However, a prerequisite for U.S. success will be measurement and data evaluation methods to enable the development and manufacture of these new technologies. For example, new nanotechnology-based photovoltaic materials—so called third-generation solar technologies—may greatly enhance the absorption properties of photocells through multi-layer structures optimized to absorb light at specific wavelengths spanning the full spectrum of the sun's output. However, the new materials lack the durability needed for commercial applications and developers need measurement tools to systematically optimize the electricity-generating properties of the devices.

By focusing on these challenges and others, NIST will continue to provide the Nation with unmatched measurement capabilities, tools, and facilities that provide key support at every level of the Nation's innovation system from ground-breaking basic research to the development of standards that promote fairness in the marketplace.

FY2011 President's Budget

Scientific and Technological Research Services: The request totals \$584.5 million (excluding a \$3.3 million transfer from the Election Assistance Commission), an increase of \$69.5 million above FY 2010. NIST's request is consistent with the intent of the President's Plan for Science and Innovation to double NIST laboratory research. With this amount, NIST will fund a total of \$69.4 million in program initiatives and the remainder for adjustments-to-base (ATBs).

I will now highlight the 10 new initiatives in our laboratory programs accounts in more detail:

Standards and Conformity Assessment for Interoperability in Emerging Technologies - (+\$10,000,000)

Lack of standards that allow interoperability within and between cross-cutting technologies such as Smart Grid and Healthcare Information Technology (Health IT) can significantly stifle the realization of benefits from these emerging technologies. Interoperability stimulates significant confidence in industry about investing in these new technologies by broadening the market and decreasing the limitations inherent in legacy systems. It also obviates potential concerns about stranded investments, which may arise due to lack of interoperability between components of systems. Furthermore, clearly defined interoperability requirements and standards to support such implementations promote innovation and competition amongst the suppliers of components to the systems, thereby reducing costs of implementation and providing greater choice to

consumers. This initiative addresses architectural framework development for documentary standards and conformity assessment requirements that will enable interoperability in emerging technologies such as Smart Grid and Health IT.

Scalable Cybersecurity for Emerging Technologies and Threats - (+\$10,000,000)

Cybersecurity is vital to the economic and national security interests of the United States. The Obama Administration has declared the cyber infrastructure a strategic asset. These networked systems face an ever-increasing threat of attack from individuals, organizations, and nation states that target key information technology operations and assets. The requested funds will support the development of tools and standards necessary to enable a robust, useable, and accessible cybersecurity framework, addressing a number of factors including cryptographic key management, security automation technologies, and improved modeling and attack detection capabilities. NIST's programs will include competitive grants to strengthen U.S. capabilities in cryptography.

Green Manufacturing and Construction - (+\$10,000,000)

Promoting innovative energy technologies to reduce dependence on energy imports and mitigate the impact of climate change while creating green jobs and new businesses is a priority of the Administration. To address this issue, NIST is focusing on programs that will develop a common framework of measurements and standards to promote sustainable operations and improve energy efficiency in both the construction and manufacturing sectors. This initiative will provide for the development of data, models, and support tools to improve energy efficiency in manufacturing and construction processes and to benchmark and stimulate the utilization of sustainable materials.

Innovations in Healthcare – Measurement Science and Standards to Support Manufacturing and Regulatory Approval of Biologic Drugs - (+\$10,000,000)

Biotechnology drugs, and protein and cell-based medications represent the fastest growing category of therapeutic drugs in the U.S. Improved characterization and manufacturing of follow-on biologic drugs will support the growth of a new industrial sector that is vital to reducing the cost of healthcare. Measurement science and standards are necessary to enable regulators to assess the “sameness” of a biologic drug made by different manufacturers and/or different manufacturing processes, and to enable manufacturers to improve efficacy and safety, and the efficiency and reliability of biopharmaceutical manufacturing processes. NIST will work with industry stakeholders to develop a program that provides reference methods for characterization of protein biopharmaceuticals' structure, function, immunogenicity and tools to test and optimize manufacturing processes. This initiative will include funds for grants to stimulate advances in biomanufacturing processes.

Innovations for 21st Century U.S. Manufacturing - (+\$10,000,000)

The President's Framework for Revitalizing American Manufacturing calls for investment in new technologies that will spur innovation and increase the competitiveness of the U.S. manufacturing sector. This initiative will enable NIST to support efforts in nanomanufacturing that will develop the metrology tools required to quickly, inexpensively, and accurately characterize products at the relevant scales of one to hundreds of nanometers; and allow in-line, fast and inexpensive nanoscale metrology techniques necessary to enable and maintain complex, multi-step assembly processes that are needed to develop true high-capacity nanomanufacturing capabilities. Working collaboratively with industry and academia NIST will also invest in programs targeted at technological innovations to increase manufacturing efficiencies in areas such as advanced sensor development, advanced robotics, and rapid prototyping.

Disaster Resilient Buildings and Infrastructure - (+\$5,000,000)

The United States depends on a robust physical infrastructure² to provide a high quality of life for its citizens and to ensure competitiveness in the global economy. Much of the Nation's enormous physical infrastructure is nearing the end of its service life, and needs to be repaired or replaced, which is estimated to cost close to \$2.2 trillion.³ Considering that a large percentage of the Nation's infrastructure is at risk from multiple natural hazards (earthquakes, fires, hurricanes) that can cause significant financial losses, it is important to ensure that as we renovate our Nation's infrastructure we do so in a way that minimizes susceptibility to damage from natural hazards. The request will fund improved techniques, tools, and guidelines for evaluating and rehabilitating existing buildings based on analytical and experimental studies, studies on the fire performance of structures, and efforts to work with national model building code organizations to incorporate those products in appropriate model building codes.

Advanced Solar Technologies -- Third Generation Photovoltaics - (+\$5,000,000)

The Administration supports the development of alternative energy sources that can meet our Nation's increasing energy needs while mitigating global climate change, reducing energy imports, and creating green manufacturing jobs. Solar energy remains one of the most promising alternative sources of energy as it is readily available, free from geopolitical issues, and does not contribute to the environmental problems associated with carbon emissions. Despite the continued growth of solar energy technologies, adoption of these technologies is limited by the relatively high-cost and low-efficiency of conventional photovoltaic solar cells. Third-generation photovoltaic technologies have the potential to overcome these barriers through the application of nanotechnology, which can enable more efficient absorption of solar energy, and simultaneously be more cost effective to manufacture. With these funds, NIST will focus on developing novel instrumentation and methods for measuring critical photovoltaic device

² Physical infrastructure includes airports, bridges, tunnels, roads, ports, and other fixed portions of transportation systems, power generation and distribution facilities, water and waste facilities, government buildings, and public arenas.

³ *ASCE 2009 Report Card for America's Infrastructure*. Available at <http://www.asce.org/reportcard/2009>.

phenomena. The request will help bridge the current gap in measurement technology needed to enable these promising new technologies.

Nanomaterial Environmental, Health and Safety - (+\$4,000,000)

There are currently over 1,000 products that contain nanomaterials on the market produced by 485 companies⁴ and valued at \$166 billion⁵; the value of nano-enabled products is projected to climb to \$2.6 trillion by 2014⁶. To ensure market viability of nanomaterials and products that incorporate these materials, it is important that manufacturers and regulators have the tools to ensure a deep and accurate understanding of the characteristics of nanomaterials. A science-based approach is needed for industry and regulatory agencies to assess and manage these risks. Regulatory agencies and industry have called on NIST to lead the effort on physical and chemical property measurements and standards. Building on our existing Nanomaterials Environmental Health and Safety program, in coordination with other agencies participating in the National Nanotechnology Initiative, NIST will identify measurement needs for critical nanomaterial characterizations, and begin developing reference nanomaterials with fully characterized physical and chemical properties.

Strategic and Emerging Research Initiatives (SERI) - (+\$2,000,000)

The SERI Fund provides the NIST Director the flexibility necessary to rapidly address high-priority research problems that require immediate attention. In addition, the SERI fund provides the NIST Director with programmatic flexibility to seed the development of new competencies that contribute effectively to future national needs and goals by investing in high-risk, high-payoff research to enable innovation.

NIST NRC Postdoctoral Research Associateships Program - (+\$3,400,000)

The Administration is committed to strengthening science, technology, engineering, and mathematics (STEM) education. The NIST National Research Council (NRC) postdoctoral program provides opportunities for outstanding young scientists to gain training in measurement science, and is a critical part of ensuring that NIST has access to the top technical talent necessary to maintain leading research programs that address critical national priorities. This request will enable NIST to support over 20 additional new post-doctoral fellowships per year.

Industrial Technology Services: The request totals \$209.6 million (including 148 permanent positions and 154 FTE). The request funds MEP at \$129.7 million, an increase of \$5.0 million above the FY 2010 enacted level (a \$4.6 million increase above the 2011 base). TIP is funded at \$79.9 million, an increase of \$10.0 million from the FY 2010 enacted level.

⁴ According to the Consumer Products Inventory maintained by the Woodrow Wilson International Center for Scholars, www.nanotechproject.org, August 25, 2009.

⁵ *The Nanotechnology Opportunity Report (NOR) 2008, 3rd Edition*, Research and Markets, June 2008.

⁶ *Taking Action on Nanotechnology's Value Chain*, Lux Research, October 2004.

Technology Innovation Program - (+\$10,000,000)

The Technology Innovation Program (TIP) supports, promotes and accelerates innovation in the United States through high-risk, high reward research in areas of critical national need. For FY 2011, NIST requests \$79.9 million, which includes an increase of \$10.0 million. These funds will support new competitions and any remaining mortgage commitments from previous competitions. Areas under consideration for potential future competitions are civil infrastructure, advanced manufacturing, energy, health care, complex systems and green chemistry. TIP funding will initiate innovative research and development (R&D) by small- and medium-sized U.S. based companies, universities, and national laboratories and other non-profit research organizations and will generate an equivalent amount of private sector R&D through the TIP cost-share provision. Further, it will foster research collaborations, enable the creation of intellectual property in the United States, disseminate new knowledge, and advance the state-of-the-art in technologies that address societal challenges. The FY 2011 request is the second year of proposed increases to the program to an eventual level of \$100 million by FY 2015.

Hollings Manufacturing Extension Partnership Program - (+\$4,637,000)

The Hollings Manufacturing Extension Partnership (MEP) program is a national network providing business and technology assistance to the Nation's manufacturing base. For FY 2011, NIST requests \$129.7 million for MEP, which includes a program increase of \$4.6 million. MEP services result in more than \$10 billion per year in increased and retained sales among thousands of manufacturing clients, and the creation and retention of more than 52,000 jobs annually. In FY 2011, MEP will continue to expand its services to better respond to future challenges and opportunities of U.S. manufacturers by supporting the adoption of technological innovations that spur economic growth and fostering the development of new products, expanded markets, process improvements, and creation of new green technology jobs. Long-term competitive advantage requires manufacturers to have access to a wide-range of resources that enable them to sell to new customers, compete in new markets, and develop new products, thus creating new, more profitable revenue streams. MEP will use additional resources in FY 2011 to expand the delivery of the collection of new services known as Next-Generation MEP. These services are focused on enabling manufacturers to strategically manage multiple factors, including continuous improvement, technology acceleration, supplier development, sustainability, and workforce challenges and opportunities in order to successfully compete over the long term in today's complex global manufacturing environment. The FY 2011 request is the second year of proposed increases to the program to an eventual level of \$180 million by FY 2015.

Construction of Research Facilities (CRF): The request totals \$124.8 million. The FY 2010 enacted level included funding that allows NIST to begin work to renovate Boulder's Building 1, and conduct a space study at the Gaithersburg site to analyze the best way to renovate aging facilities. The FY 2011 request includes \$66.1 million of initiative funding above the FY 2010 base amount for CRF to continue the Building 1 Renovation, begin design and planning for General Purpose Laboratories (GPL), and to provide a sufficient level of funding for NIST to

address deficiencies and maintain NIST's physical plant. NIST will invest these funds in the following manner:

Safety, Capacity, Maintenance, and Major Repairs (SCMMR) - (+\$13,832,000)

Aging and deteriorating buildings and infrastructure threaten NIST's ability to meet its mission. NIST's SCMMR program funds capacity, safety improvements, as well as ongoing, recurring and preventative maintenance and major repair of the NIST physical plant in Gaithersburg, Maryland; Boulder and Fort Collins, Colorado; and Kauai, Hawaii. NIST requires a \$13.8 million increase to the SCMMR base program to bring the program total to approximately \$72.5 million, which will provide a sufficient level of funding to address repair deficiencies and maintain NIST's physical plant with on-going, recurring, and preventative maintenance.

Boulder Laboratories Building 1 Renovation (+\$37,900,000)

This initiative is part of a long-term plan to renovate Building 1 of the NIST Boulder laboratories, which houses the majority of NIST Boulder research and measurement. The requested funding will allow NIST to continue with the efforts made in FY 2010. Specific work will include the exterior renovations of Wings 3, 5, 6, and the Center Spine, and the interior renovation of Wing 3 as well as most of Wing 5. The successful improvement of the NIST Boulder facilities – through construction of the Precision Measurement Laboratory and the extensive renovation of parts of the existing facilities – will enable NIST to support scientific discovery and technical development of transformational technology in homeland security, telecommunications, nanotechnology, precision timekeeping, hydrogen energy sources, precision electrical standards, biotechnology, applications of lasers, electromagnetic interference testing, quantum computing and quantum communications, and other national needs.

General Purpose Laboratories (GPLs) Renovations - (+\$14,400,000)

Nearly 45 years old, the Gaithersburg site GPLs house the majority of NIST research and measurement. Aging structural, mechanical, electrical, and safety systems significantly reduce the research and measurement productivity of the NIST Gaithersburg laboratories. This initiative is part of a comprehensive, multi-year plan for the phased renovation of all the GPLs at the NIST Gaithersburg laboratories. In FY 2010, a \$2.0 million Gaithersburg site space utilization study was funded. This FY 2011 request of \$14.4 million will provide funding for the initial cost of the planning documents based on the results of the FY 2010 study. This initiative will identify the phasing plans, the basis of design and budget for each phase of the renovation program. A comprehensive schedule will be developed for the GPL renovations as part of this initiative.

Summary

For more than 100 years, NIST has maintained the national standards of measurement, a role that the U.S. Constitution assigns to the Federal Government to ensure fairness in the marketplace. The FY2011 budget request for NIST reflects the Administration's recognition of the important

role that NIST plays in innovation and the impact that the research and services NIST provides can have on moving the Nation from recession to recovery by laying the foundation for long-term job creation and prosperity.

I look forward to working with you Mr. Chairman and members of the Subcommittee and would be happy to answer any questions.

Dr. Patrick D. Gallagher, Director



Dr. Patrick Gallagher was confirmed as the 14th Director of the U.S. Department of Commerce's National Institute of Standards and Technology (NIST) on Nov. 5, 2009. Gallagher provides high-level oversight and direction for NIST. The agency promotes U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology. NIST's FY 2009 resources total \$1.6 billion and the agency employs about 2,900 scientists, engineers, technicians, support staff and administrative personnel at two main locations in Gaithersburg, Md., and Boulder, Colo. In addition to \$819 million in FY09 appropriations and \$125 million from other agencies, the American Recovery and Reinvestment Act of 2009 provides a total of \$610 million to NIST for building critically needed research facilities, expanding fellowships and research grants, and addressing important national priorities critical to the nation's future.

Gallagher had served as Deputy Director since 2008. Prior to that, he served for four years as Director of the NIST Center for Neutron Research (NCNR), a national user facility for neutron scattering on the NIST Gaithersburg campus. The NCNR provides a broad range of neutron diffraction and spectroscopy capability with thermal and cold neutron beams and is presently the nation's most used facility of this type. Gallagher received his Ph.D. in Physics at the University of Pittsburgh in 1991. His research interests include neutron and X-ray instrumentation and studies of soft condensed matter systems such as liquids, polymers and gels. In 2000, Gallagher was a NIST agency representative at the National Science and Technology Council (NSTC). He has been active in the area of U.S. policy for scientific user facilities and was chair of the Interagency Working Group on neutron and light source facilities under the Office of Science and Technology Policy.