

Testimony of

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Before the  
United States House of Representatives  
Committee on Science, Space and Technology

An Overview of the Fiscal Year 2012 Budget for the  
National Science Foundation and the  
National Institute of Standards and Technology

March 11, 2011

Chairman Hall, Ranking Member Johnson, and members of the Committee, thank you for the opportunity to appear before you today to present the President's Fiscal Year (FY) 2012 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. As the President has said... "*We know what it takes to compete for the jobs and industries of our time. We need to out-innovate, out-educate, and out-build the rest of the world.*"<sup>1</sup> The NIST FY 2012 budget clearly lays out the NIST role in the Administration's priorities by making critical investments in key areas that will help preserve our nation's economic security and strengthen American competitiveness.

Mr. Chairman, I would like to start with a quick mention of the context of this budget. Overall, this is a very difficult budget environment. The President made clear that it was important for the government to live within its means and establish some priorities within those limits. The President has focused on a number of key goals, including innovation, infrastructure and education.

Within that context, NIST finds itself with a mission that's very well aligned to those goals. Over the past few years, numerous reports have underscored the importance of a robust Federal presence in the sciences to advance technological innovation. The "*Rising Above the Gathering Storm*" report and its follow-on, "*The Gathering Storm, Revisited*," were a clarion call to action that helped to shape the America COMPETES Reauthorization Act that this Committee championed and the President signed into law earlier this year. In addition, in February of this year, the White House Office of Science and Technology Policy, National Economic Council, and Council of Economic Advisers jointly released an update to the 2009 "*Strategy for American Innovation*" that "focuses on critical areas where sensible, balanced government policies can lay the foundation for innovation that leads to quality jobs and shared prosperity."

The NIST mission is to promote U.S. innovation and industrial competitiveness through measurement science, standards and technology. The NIST mission is very well-aligned with the priority goals that the President has laid out. The FY 2012 budget for NIST reflects that alignment.

Mr. Chairman, the President's FY 2012 discretionary budget request for NIST is \$1 billion, a 17 percent increase over the FY2010 enacted level. The budget maintains the President's commitment to double the NIST laboratory budget, and to support and enhance our world leadership in the physical sciences and technology.

The NIST budget is comprised of three discretionary spending accounts and one new proposed mandatory spending account.

For the NIST laboratories, the budget requests \$679 million to accelerate the development of standards, technology, and measurement science in areas as diverse as advanced manufacturing technologies, cybersecurity, and infrastructure. The request reflects a net increase of \$173.6 million over the FY 2011 annualized CR level. We did not continue funding \$10.5 million in

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<sup>1</sup> **Remarks by the President in State of Union Address on January 25, 2011.**

previous year earmarks and redirected this amount to new initiatives. Thus, the budget proposes \$178.5 million in laboratory initiatives and \$5.6 million in adjustments to base.

For the NIST Industrial Technology Services (ITS) account, the budget requests \$238 million, an increase of \$33 million over FY 2011 annualized CR levels. The account includes NIST's external programs: the Technology Innovation Program (TIP), the Hollings Manufacturing Extension Partnership (MEP), the Baldrige Performance Excellence Program (BPEP) and the newly proposed Advanced Manufacturing Technology Consortia (AMTech) program. The request includes \$12.3 million for the AMTech, a new cooperative grant program with industry and academia to foster public-private partnerships to develop needed technology to support advanced manufacturing industries that will broadly benefit the Nation's industrial base. Also in the ITS line is a \$1.9 million reduction to BPEP from the FY 2011 annualized CR levels.

The budget requests \$84.6 million for the Construction of Research Facilities (CRF) account; representing a \$62.4 million decrease from the FY 2011 annualized CR level. The request includes \$25.4 million for the continued renovation of the Boulder Building 1 renovation but does not include \$67 million in FY 2010 earmarks and the Construction Grant Program.

Finally, NIST requests \$100 million in mandatory appropriations for the Public Safety Innovation Fund, NIST's component of the Wireless Innovation Fund, which itself is part of the President's Wireless Innovation and Infrastructure Initiative (WI3). This mandatory appropriation request will fund NIST's safety efforts in this area, with particular focus on working with industry and public safety organizations to develop new standards, technologies, and applications to advance public safety.

Let me speak in more depth about the major thematic initiatives in this request: manufacturing, infrastructure, and education. These themes directly relate to the President's stated goals to "out-innovate, out-educate, and out-build."

### ***Out-Innovate: Supporting Innovation for a Strong Manufacturing Base.***

In order to "Out-Innovate," the U.S. must have a strong manufacturing base. With that focus innovation in manufacturing is key to the NIST 2012 budget. 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.

The U.S. manufacturing sector, still the world's largest, is the nation's innovation engine. Manufacturers perform half of all research and development in the U.S., and they employ 17 percent of the nation's scientists and engineers. The sector develops, builds, and supplies the advanced equipment that enables the U.S. military to maintain technological superiority over our adversaries.

Providing the measurement tools and other essential technical assistance that existing U.S. manufacturers and aspiring start-ups need to invent, innovate, and produce—more rapidly and more efficiently than their competitors—is a top NIST priority. NIST has partnered with the manufacturing sector for over a century. Today's challenges require stepping up efforts to

enhance and strengthen the nation's underlying technical infrastructure, which is integral to our innovation and advanced manufacturing capabilities.

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 developing new markets. The nation's manufacturers 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.<sup>2</sup>

### **2012 Manufacturing Initiatives:**

The President's FY 2012 budget for NIST includes five manufacturing-related initiatives in NIST's scientific laboratories that will enable NIST to bolster and diversify needed research and promote proven services that will strengthen U.S. manufacturing competitiveness in high-value-added product markets.

- **Strengthening Measurement Services in Support of Industry Needs (\$20.0M)** The U.S. economy depends upon a robust and reliable physical science-based measurement system. Industry is increasingly relying upon and utilizing NIST's precision time and synchronization services to drive innovation. Industries as diverse as telecommunications, electric power distribution, broadcasting, and navigation networks, as well as many crucial applications in national defense, intelligence, and homeland security rely on NIST calibrations and measurement services. In aeronautics, for example, NIST calibrations for commercial and federal government partners ensure the accuracy and performance of altimeters and electrical systems that enable F-18s and commercial aircraft to fly. This initiative will enhance systems for distributing NIST measurement services to meet the growing demand from industry for such services.
- **Advanced Materials for Industry (\$14.2M)** The discovery and optimization of new materials is costly and inefficient. Today, U.S. researchers can design and create new materials at a rate that outpaces our ability to support the measurements to characterize and exploit these discoveries. NIST efforts in advanced materials development and measurement science can help manufacturers save millions of dollars in design costs. This initiative will help to provide that support to industry through the development of a national measurement and standards infrastructure necessary to enable computer modeling and simulation capabilities for discovering new materials and reliably optimizing structures and properties for manufacturing processes and product performance and features.
- **Innovations for 21st Century U.S. Manufacturing: Faster, Smarter and Cleaner (\$13.3M)** Innovation is central to manufacturing, and in turn, to the overall growth and health of the U.S. economy. The ability to *rapidly* introduce product innovations provides a foundation for future growth in U.S. manufacturing and with it, the creation and retention of high-skill, well-paying jobs. This initiative will fund efforts to develop

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<sup>2</sup> Executive Office of the President, *A Framework for Revitalizing American Manufacturing*, Dec. 2009.

advanced robotics technologies that allow the U.S. to retain manufacturing competitiveness, and fund programs that will promote sustainable operations and improve energy efficiency in both the manufacturing and construction sectors of the economy.

- **Measurement Science and Standards to Support Biomanufacturing (\$9.5M)** The high cost of biotechnology medicines is adversely impacting the U.S. healthcare system and economy. Biotechnology drugs, currently dominated by protein therapeutics, are the fastest-growing class of pharmaceuticals and the fastest growing (~20%/year) category of health care spending.<sup>[1]</sup> Inefficiencies in the manufacturing process contribute to the high cost of these drugs. Under this initiative, NIST will work closely with industry, the FDA, and other standards organizations to better understand the manufacturing process resulting in higher quality biologic products through continuous improvement of manufacturing processes. It will also enable the development of agile biomanufacturing processes required for next generation products such as stem cells and personalized biotherapeutics.
- **Measurements to Support the Manufacture and Production of Nanotechnology-based Products (\$28.2M)** There remain significant barriers to the full commercial exploitation of nanotechnology. The lack of manufacturing and characterization tools adds significantly to the development cost of nano-based products. Rigorous measurement science is needed to characterize the environmental, health, and safety risks of engineered nanomaterials. NIST's expertise in measurement science as well as its world-class nanotechnology fabrication facilities at the Center for Nanoscale Science and Technology (CNST) in Gaithersburg, Maryland, provides industry unique resources to advance the measurement science needed to enhance our understanding of the safety of nanomaterials, and fund research on the development and manufacture of cost-competitive technologies. This initiative will position the U.S. to be globally competitive in emerging technologies through safe use of nanotechnology. It will also provide needed investments in the CNST to keep it at the cutting-edge of innovation.

The President's budget strongly supports manufacturing through the Industrial Technology Services programs.

### **Hollings Manufacturing Extension Partnership (MEP)**

The President's 2012 Budget requests \$142.6 million for the MEP program. This request is a \$17.9 million increase over the FY 2011 annualized CR level. The MEP is a federal-state partnership which requires a two-thirds financial match from non-NIST sources. Through its national network of MEP Centers located in every state, 1,400 technical experts help small- and medium-sized manufacturers navigate economic and business challenges and connect to public and private resources essential for increased competitiveness and profitability.

Through competitively awarded cooperative agreements, NIST MEP will expand the capabilities of its nationwide network of centers to accelerate commercialization of technological

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<sup>[1]</sup> Biotech 2008 – Life Sciences: A 20/20 Vision to 2020, Burrill and Company, 2008.

innovations, adopt environmentally sustainable business practices, promote renewable energy initiatives, foster market diversification, and connect domestic suppliers to manufacturers to assist manufacturers in successfully competing over the long term in today's complex global manufacturing environment.

### **The Technology Innovation Program (TIP)**

The FY 2012 request for TIP is \$75 million. The proposed TIP budget represents an increase of \$5.1 million above the FY 2011 annualized CR level. TIP funds cutting edge, transformative research and development projects that address critical national needs and societal challenges not already being addressed by others. TIP requires a 1:1 match of funds from the private sector. In FY 2012, TIP expects to hold a funding competition in one or more of the following research areas: advanced robotics and intelligent automation, energy, healthcare, water, civil infrastructure technologies, and manufacturing.

TIP funding will incentivize innovative research and development (R&D) projects, conducted by small- and medium-sized U.S. based companies, alone or as joint ventures with universities, national laboratories and other non-profit research organizations. 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. In its most recent round of funding for manufacturing projects, TIP awardees included those young, small companies which are the engines of innovation and the future generators of globally competitive jobs.

### **Advanced Manufacturing Technology Consortia (AMTech)**

NIST is also requesting \$12.3M for the Advanced Manufacturing Technology Consortia (AMTech) program, a new public-private partnership that will broadly benefit the Nation's industrial base by providing grants to form and fund industrial consortia to address industrial driven technological challenges that no one company can address alone. AMTech is modeled upon NIST's successful partnership, the Nanoelectronics Research Initiative, which in collaboration with industry, funds research consortia targeting the nanoelectronics technology sector.

AMTech will collapse the timescale of technological innovation by including partners that span the innovation lifecycle from idea to discovery, from invention to commercialization. Through cost-sharing and a common research agenda, these consortia would support the development of innovative new technologies directed at creating high-wage jobs and economic growth across the industry sector. These consortia will develop road-maps of critical long-term industrial research needs and provide support for research and equipment at leading universities and government laboratories directed at meeting these needs.

### ***Out-Build: Building the Nation's Infrastructure – Cyber, Physical and Wireless***

To meet the President's challenge to "*Out-Build*" other nations, NIST is requesting funds in the FY 2012 budget to strengthen the U.S. infrastructure in three main areas: the cyber infrastructure, the physical infrastructure and the wireless infrastructure.

**Cybersecurity Infrastructure.** A secure cyber infrastructure is vital to the economic vitality 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 critical functions such as air traffic control, electric power distribution and the GPS in our cars. The nation's cyber infrastructure is central to maintaining the timely delivery and quality of public services that are part of everyday life. Our nation's computers face ever-increasing threats from malicious individuals, organizations, and nation states. Currently, our computer security tools are manually implemented, too complex to be effectively used, and too static to respond to rapid changes in the threat environment. 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.

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. The FY 2012 budget request contains \$43.4 million for cybersecurity related programs and activities that will strengthen NIST's contribution to the development and promulgation of effective and usable cybersecurity standards.

The cybersecurity infrastructure request has three initiatives.

- **Scalable Cybersecurity for Emerging Technologies and Threats (\$14.9M)** The request would provide improvements to NIST's core cybersecurity work in support of the Comprehensive National Cybersecurity Initiative (CNCI), the Federal Information Security Management Act (FISMA), and other national priorities. NIST will develop improved security techniques, support the creation of consensus security standards, increase the interoperability and usability of security technologies, and expedite the secure adoption of emerging information technologies.
- **National Program Office for the National Strategy for Trusted Identities in Cyberspace (NSTIC) and NSTIC Grant Program (\$24.5M)** The request would support a National Program Office (NPO) to coordinate federal activities needed to implement NSTIC. This initiative is in direct response to the recommendations of the *White House Cyberspace Policy Review* and will raise the level of trust associated with the identities of individuals, organizations, services, and devices involved in online transactions. NIST will be responsible for day to day and overall operation of the NPO. NIST will work with the private sector to identify potential funding opportunities for the delivery of NSTIC solutions. Of the \$24.5 million for NSTIC, \$7.0 million will support a National Program Office and \$17.5 million will fund the pilot grants.
- **National Initiative for Cybersecurity Education (NICE) (\$4.0M)** The request supports NICE, which expands the scope of the Comprehensive National Cybersecurity Initiative's (CNCI) Education Initiative from the training of the Federal workforce to a larger national education focus. NIST will develop a cybersecurity education framework that addresses: national cybersecurity awareness, formal cybersecurity education, Federal

cybersecurity workforce structure, and cybersecurity workforce training and professional development.

**Interoperability of Infrastructure.** Other critical emerging technologies such as the Smart Grid and national health care information systems have the potential 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 systems. 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 contains an initiative that will support continued efforts in these critical areas as well as provide the infrastructure necessary to address other emerging interoperability challenges.

- The **Interoperability Standards for Emerging Technologies Initiative (\$23.8M)**, will focus on the development of standards to enable or accelerate the successful development of new technologies such as a smart electrical grid (Smart Grid), interoperable electronic healthcare records, and cloud computing. These technologies have the potential to transform our society and galvanize U.S. industry, and provide new opportunities for exports of U.S.-developed technologies. For each technology to be effective, however, many complex interconnected components must be built to be enable full interoperability and reduce the full potential of these technologies. Lack of standards for interoperability can significantly slow adoption of these emerging technologies, dampen confidence in industry, and increase the risks of stranded investments in solutions that quickly become obsolete.

**Physical Infrastructure.** Buildings in the U.S. consume 72 percent of all electrical energy produced in this country. Emissions associated with buildings and appliances are projected to grow faster than those from any other sector. To ensure adequate supplies of energy and curtail the projected growth of carbon dioxide emissions, it is essential to reduce building energy consumption significantly while minimizing the environmental impacts of buildings during their life cycles. In addition, many of the nation's largest buildings and much of its infrastructure are concentrated in disaster-prone regions where hurricanes, earthquakes, floods and other hazards are common. Catastrophic failures in infrastructure as a result of natural disasters are costly and directly impact our personal and economic health. NIST is requesting funds for two initiatives that will further the development of a stronger building infrastructure.

- **Measurements and Standards to Support Increased Energy Efficiency and Reduced Environmental Impact initiative (\$13.3M)** This initiative will fund research in Net-Zero Energy Building (NZEB) design. NZEB designs would use as much energy from renewable sources as they consume. Such design also doubles the service life of building materials, products, and systems in order to minimize their lifecycle impacts - this also takes indoor air quality into account. Current analysis methods are not able to assess the indoor air quality impacts of key design decisions or impacts of new technologies. This initiative will provide the measurement science required to achieve net-zero energy, high-performance buildings. It will also provide the measurement science to support gas measurement standards to ensure their accuracy and comparability.

- **Measurements and Standards to Support Advanced Infrastructure Delivery and Resilience (\$10.6M)** The disaster resilience of our structures today is determined in large measure by the building codes, standards, materials, and practices used during their construction. There are gaps in the measurement science needed to improve the disaster resilience of infrastructure exposed to natural and man-made hazards. This request funds efforts to provide improvements to our nation’s physical infrastructure to damage from earthquakes, windstorms, and fire. This funding will also develop comprehensive measures of construction practices so our Nation’s building infrastructure can be both more efficiently built and more resilient.

**Wireless Infrastructure.** The request to create the Public Safety Innovation Fund (PSIF), a mandatory account within NIST funded at \$100 million (\$500 million over five years) is part of the Administration’s Wireless Innovation and Infrastructure Initiative (WI3).

President Obama called for a National Wireless Initiative to make available high-speed wireless services to at least 98 percent of Americans. The WI3 will make it possible for businesses to achieve that goal, while freeing up spectrum through incentive auctions, spurring innovation, and supporting a nationwide, interoperable wireless network for public safety. An important element of this plan is the reallocation of the D Block for public safety, and some of the proceeds from the incentive auctions being dedicated to NIST research, experimentation and testbeds. The funds will also focus on applied development to foster the development of a next-generation Public Safety communications network.

Specifically, to spur innovation, the WI3 includes a Wireless Innovation (WIN) Fund for research and development of emerging wireless technologies and applications. NIST will focus on applied development to foster the development of a next-generation Public Safety communications network. The current systems for 4G high speed wireless services are not tailored for public safety’s requirements. Developing and implementing such requirements, including capabilities to enable handsets to operate in peer-to-peer (or without the aid of a central network) will require technological leadership that NIST can help provide. NIST, in consultation with agency partners, including the National Institute of Justice at the Department of Justice and the Department of Homeland Security, will focus on developing and testing requirements, standards, wireless applications, and other wireless technologies in support of an interoperable nationwide Public Safety Broadband Network.

### ***Out-Educate: Training the Next Generation of Scientists.***

In order to “*Out-Educate,*” each agency must do its part. While NIST does not have a primary mission in education, the future development of the nation’s scientists is critical to the future of NIST. NIST has an important role to play in helping to identify, recruit, and retain the next generation of scientists and engineers to help drive American competitiveness. There is one initiative associated with this area:

- **The Postdoctoral Research Associateship Program (\$3.0M)** This highly competitive program is very effective at attracting outstanding scientists and engineers to consider a career in science by providing opportunities to work alongside NIST researchers. I want

to thank the Committee for its support in eliminating the cap on funding for the post-doc program. The elimination of this cap allows NIST to fund more associates. The requested increase will enable the program to offer at least an additional 23 positions per year and keep the pipeline of bright, new scientists flowing.

- **National Initiative for Cybersecurity Education (NICE) (\$4.0M)** As mentioned earlier, the request supports NICE, which expands the scope of the Comprehensive National Cybersecurity Initiative's (CNCI) Education Initiative from the training of the Federal workforce to a larger national education focus.

**Construction of Research Facilities (CRF):** The FY 2012 request totals \$84.6 million, a \$62.4 million decrease over the FY2011 annualized level. The request contains \$25.4 million to continue the renovation of the 60-year-old Building 1 on the NIST Boulder campus, which houses the majority of research and measurement laboratories on the Boulder campus. The balance of the account, \$59.2 million, will provide funding for NIST to address deficiencies and maintain NIST's laboratories and facilities. The decrease reflects the elimination of congressionally-directed projects from FY 2010.

**Budget Decreases:** Finally, let me touch on two areas in which the budget reflects savings:

The Administration's Administrative Efficiency Initiative challenged all agencies to identify savings as part of the budget development process. NIST's FY 2012 budget incorporates over \$11 million in administrative savings across the agency in order to make the agency more efficient and effective in an era of tight budgets.

The Baldrige Performance Excellence Program (BPEP) requests \$7.7 million, \$1.9 million less than the FY 2011 annualized CR level. The FY 2012 funding supports the continued development of the Baldrige Program Criteria, dissemination of best practices, and the annual awards process. At the proposed level, BPEP will evaluate alternative sources of funding and alternative cost models consistent with the administration's goal of transitioning the program out of federal funding.

## Summary

In summary, I would like to note that for more than 100 years NIST has maintained the national standards of measurement. This role was assigned by the U.S. Constitution to the Federal Government to promote industry and ensure market fairness. The FY 2012 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 forward by laying the foundation for long-term job creation and prosperity. By sustaining our investments in fundamental research, we can ensure that America remains at the forefront of scientific capability, thereby enhancing our ability to shape and improve our nation's future and that of the world around us.

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

## **Dr. Patrick D. Gallagher, Under Secretary of Commerce for Science and Technology and 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. He also serves as Under Secretary of Commerce for Standards and Technology, a new position created in the America COMPETES Reauthorization Act of 2010, signed by President Obama on Jan. 4, 2011.

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 2010 resources include \$856.6 million from the Consolidated Appropriations Act of 2010 (Public Law 111-117), \$49.9 million in service fees, and \$101.5 million from other agencies. The agency employs about 2,900 scientists, engineers, technicians, support staff, and administrative personnel at two main locations in Gaithersburg, Maryland and Boulder, Colorado.

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. Currently, he serves as co-chair of the Standards Subcommittee under the White House National Science and Technology Council.