TECHNOLOGY ADMINISTRATION

OFFICE OF THE UNDER SECRETARY FOR TECHNOLOGY

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

NATIONAL TECHNICAL INFORMATION SERVICE

FISCAL YEAR 2008

BUDGET REQUEST TO CONGRESS

Department of Commerce
Technology Administration
Office of the Under Secretary for Technology
BUDGET ESTIMATES, FISCAL YEAR 2008
CONGRESSIONAL SUBMISSION

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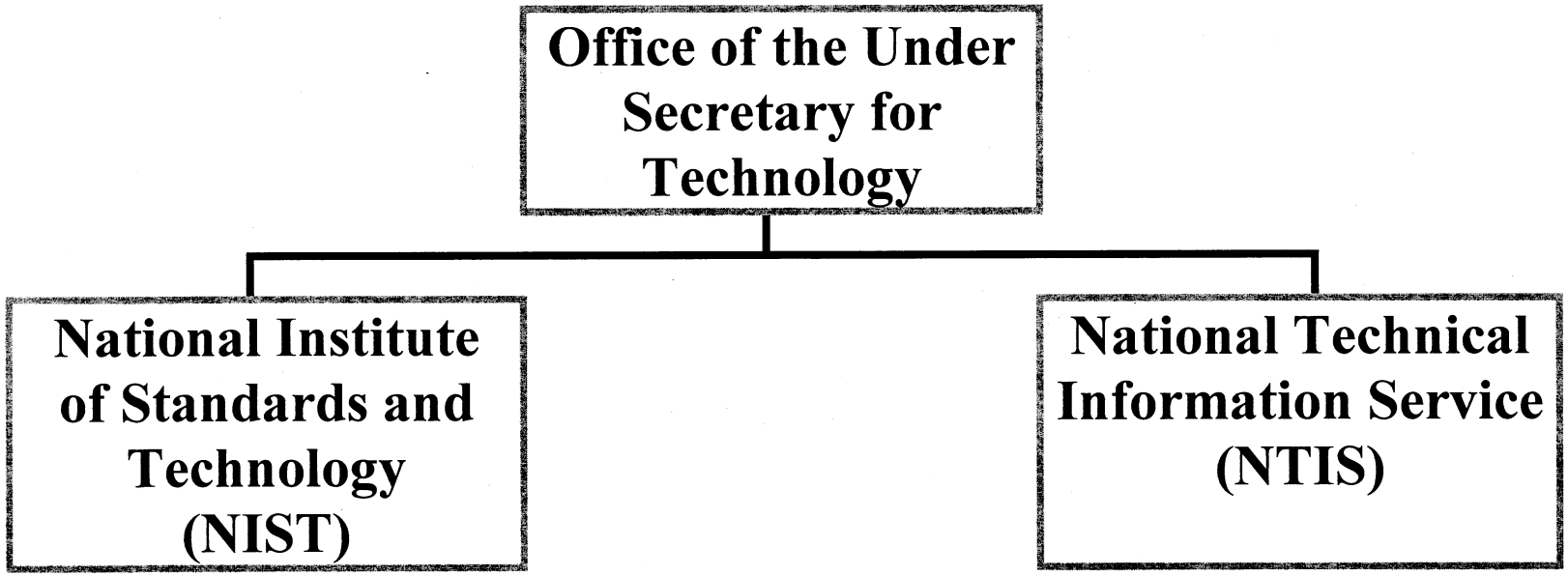
Technology Administration



DEPARTMENT OF COMMERCE
TECHNOLOGY ADMINISTRATION
Budget Estimates, Fiscal Year 2008
Congressional Budget Submission

EXECUTIVE SUMMARY

Goals of the Program

The United States continues to lead the world in developing and commercializing new technologies. From information technology to biotechnology to nanotechnology, U.S. scientists and high-tech workers are generating new products and trailblazing revolutionary discoveries every day. These discoveries and advances in technology are occurring at a phenomenal rate – it is estimated that about 90 percent of all scientific knowledge has been generated over the last 30 years. Both the rate of generation of new technology and the number of workers globally engaged in science and technology may double again over the next 15 years. With computer processing power and genomic data also doubling every 18 months or faster, the probability is that technology and the face of U.S. industry will change more in the next 30 years than all of that which occurred in the last century.

Driven by convergence, globalization, and radically disruptive new technologies such as nanotechnology, changes in the 21st century are coming faster, disruptions to legacy business models and products are cutting deeper, and the nations, firms, and individuals who succeed will be those best able to adapt. The radical rate of technological advancement, coupled with an estimate by leading economists that technological progress accounts for as much as 50 percent of the Nation's long-term economic growth,[1] underscores the need for preparing the Nation, American workers, and industry to compete in a disruptive global marketplace. While the United States may be better positioned for technological growth than most nations, competitors are rapidly gaining and pressing their own comparative advantages. The future will be global, competitive, technologically intensive, and rapidly changing. The investment in technology is vital to our economic growth, the Nation's industries, and American workers. Our Nation's science and technology enterprise is now linked to our continued commitment to promoting effective technology policy, providing for research and development investments, and developing an infrastructure for effective technology commercialization.

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[1] *Boskin, M. and L. Lau [2000], "Generalized Solow-Neutral Technical Progress and Postwar Economic Growth," National Bureau of Economic Research Working Paper No. W8023 (December 2000).*

Technological innovation is critical to our Nation for many reasons. First and foremost, technology fuels sustainable economic expansion – creating high-wage jobs and world-class exports, and driving productivity and growth critical to our long-term global competitiveness. Innovations also improve our quality of life – from new drugs and cures that help people live longer and healthier lives to agricultural advances that permit more bountiful harvests with less herbicides and pesticides. Advances in technology are vital to our efforts to protect our homeland, hardening our infrastructure, detecting dangers, and empowering our defenders. Energy innovations are the key to meeting our future power needs while protecting our environment, and technology holds extraordinary promise for the future of education. The Nation will need to develop management approaches and systems that can anticipate and address rapid and complex changes in the marketplace. This means improved learning environments and training opportunities. We will need to find ways to boost the productivity and effectiveness of American knowledge workers to overcome global wage disparities by building a dynamic and responsive re-skilling environment that uses innovation to generate new jobs, companies, and opportunities.

The United States has sought to address these new economic and competitive realities by developing both domestic and international policies and programs that enhance U.S. competitiveness in the global marketplace and enhance technology's contribution to national economic growth, job creation, and quality of life. A role for government has been articulated for emphasizing the creation of a favorable business climate to promote innovation. The Commerce Department's Technology Administration (TA) has served as a focal point for these efforts, helping to ensure that American companies and workers have the tools needed to compete and win in today's global economy. Beginning in FY 2008, TA's Office of the Under Secretary is proposed to be terminated and its policy activities will be elevated to the Secretary's office. A brief description of the component bureaus of TA is provided below.

The **National Institute of Standards and Technology (NIST)** has a 100-plus-year track record of serving U.S. industry, science, and the public with a mission and approach unlike any other agency of government; and it is well positioned—as a nexus between academia and industry—to help enhance U.S. economic competitiveness and quality of life. Technology-based innovation remains one of the Nation's most important competitive advantages, and helping the United States to drive and take advantage of the increased pace of technological change is one of NIST's top priorities. The new technologies that are determining the global winners in the early 21st century—including nanotechnology, information technology, and advanced manufacturing—rely on NIST-developed tools to measure, evaluate, and standardize. These emerging technologies, in turn, will enable U.S. companies to innovate and remain competitive. NIST manages some of the world's most specialized measurement facilities, including an unmatched and extraordinarily cost-effective NIST Center for Neutron Research user facility where cutting-edge research is carried out on new and improved materials, advanced fuel cells, and biotechnology; the Advanced Measurement Laboratory, which is the most technically advanced research facility of its kind in the world; and the Center for Nanoscale Science and Technology, which is a new effort that will bring together a multidisciplinary team from across NIST, industry, academia, and other government agencies to support all phases of nanotechnology development, from discovery to production. NIST's resources include about 2,900 employees, comprised of

three Nobel Prize winners, 1,800 visiting researchers, and 1,400 affiliated field agents that collaborate to make NIST a globally respected source of information and research that drives innovation in business and in the research laboratory. In addition to its core measurement, testing, and standards functions that are carried out by its laboratories, NIST also conducts key extramural programs: the Hollings Manufacturing Extension Partnership Program, to strengthen the competitiveness of thousands of America's small and mid-sized manufacturers with a broad array of technical and business support services ranging from plant modernization and employee training to business practices and information technology; and the Baldrige National Quality Program, to help U.S. business and other organizations improve the performance of their operations by providing clear standards and benchmarks of quality.

The **National Technical Information Service (NTIS)** operates a central clearinghouse of scientific, technical, and engineering information and makes this information perpetually and widely available to U.S. businesses, industry, and consumers. NTIS collects scientific, technical, and engineering information; catalogs, abstracts, indexes, and permanently archives the information, disseminating products in the forms and formats most useful to its customers; develops electronic and other new media to disseminate information; and provides information processing services to other Federal agencies. NTIS promotes economic growth and opportunity by (a) collecting, organizing, and disseminating scientific, technical, engineering, and related business information produced by or for Federal agencies and (b) providing sophisticated services to other Federal agencies that help them interact with and better serve the information needs of their own constituents.

Statement of Objectives

TA's two component bureaus, NIST and NTIS, address all six elements of the President's Management Agenda and focus on addressing the Departmental Strategic Goals to ***Promote U.S. Innovation and Industrial Competitiveness by Protecting Intellectual Property, Enhancing Technical Standards and Advancing Measurement Science and to Provide the Information and Tools to Maximize U.S. Competitiveness and Enable Economic Growth for American Industries, Workers, and Consumers***. In its programmatic agency, NIST helps to foster strong communities by providing the Nation's core measurement, testing and standards; helping smaller businesses adopt new manufacturing and management technologies; and helping U.S. industries improve their performance and quality. In its information dissemination role, NTIS promotes economic growth by ensuring that technical, engineering, and related business information is readily available to support the innovative process. In FY 2008, NIST and NTIS will continue to promote the development and diffusion of technologies and standards critical to sustained economic growth for our Nation's communities through a comprehensive mix of policy and programmatic activities.

The programmatic goals of TA's component bureaus are to:

- Promote innovation, facilitate trade, and ensure public safety and security by strengthening the Nation's measurement and standards infrastructure. (NIST)
- Raise the productivity and competitiveness of small manufacturers. (NIST)
- Enhance public access to worldwide scientific and technical information through improved acquisition and dissemination activities. (NTIS)

Summary of Proposed Budget

The total budget request in FY 2008 for TA, including its component agencies, is $642,271,000, 3,071 permanent positions, and 3,108 FTE (all organizational positions and FTE include reimbursable program staff). Outlined below are the summary highlights of the TA FY 2008 budget.

Technology Administration/Under Secretary for Technology

The budget request for TA/Under Secretary for Technology is $1,557,000 and 2 FTE to conduct an orderly shut down of the Office, which includes $176,000 for anticipated severance payments which will continue into FY 2009.

Technology Administration/National Institute of Standards and Technology

The budget request for NIST totals $640,714,000, 2,791 permanent positions, and 2,906 FTE. This request supports NIST's unique mission to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve quality of life. The justification for NIST's budget request can be found beginning on page NIST-1 of this document.

Technology Administration/National Technical Information Service

The budget request for the NTIS includes zero dollars, 280 Permanent Positions, and 200 FTE. The NTIS budget submission can be found beginning on page NTIS-1 of this document.

FY 2008 Annual Performance Plan

Technology Administration

Mission Statement

The Technology Administration's mission is to maximize technology's contribution to economic growth, high-wage job creation, and the social well being of the United States by advocating for technological innovation in the government policy arena and other key national and international organizations; analyzing factors that affect U.S. technological innovation and competitiveness; developing and promoting measurements, standards, and technology to enhance productivity, trade, and the quality of life; and providing access to information that stimulates innovation and discovery.

The Technology Administration (TA) works with industry and other stakeholders to maximize technology's contribution to U.S. economic growth. Through its two component bureaus, the National Institute of Standards and Technology (NIST) and the National Technical Information Service (NTIS), TA fulfills its broad responsibilities and contributes to the Department's strategic goal of promoting U.S. innovation and industrial competitiveness by encouraging the development of the technological infrastructure required to support U.S. industry through the 21st century; fostering the development, diffusion, and adoption of new technologies; disseminating information on U.S. and foreign technology strategies and best practices; and creating a business environment conducive to innovation.

National Institute of Standards and Technology

NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life. NIST develops and disseminates measurement techniques, reference data, test methods, standards, and other infrastructural technologies and services required by U.S. industry to compete in the twenty-first century. In addition to its core measurement, testing, and standards functions, NIST also conducts extramural programs including the Hollings Manufacturing Extension Partnership (MEP) to help smaller firms adopt advanced manufacturing and management technologies and improve their overall competitiveness and the Baldrige National Quality Program to help U.S. businesses and other organizations improve the performance and quality of their operations by providing clear standards and benchmarks of quality.

Each of NIST's major programs and their corresponding strategic goals outlined below contributes to the Department's mission to create the conditions for economic growth and opportunity by promoting innovation, entrepreneurship, competitiveness, and stewardship.

NIST: Programs, Core Functions, and Strategic Goals

Program	Core Functions	Strategic Goals
Laboratories	Conducting research that advances the Nation's technology infrastructure and is needed by U.S. industry to continually improve products and services	1. Promote innovation, facilitate trade, and ensure public safety and security by strengthening the Nation's measurement and standards infrastructure.
Hollings MEP	Providing technical and business assistance to smaller manufacturers	2. Raise the productivity and competitiveness of small manufacturers.
Baldrige	Promoting performance excellence among U.S. manufacturers, service companies, small businesses, educational institutions, health care providers, and nonprofit organizations	3. Catalyze, recognize, and reward quality and performance improvement practices in U.S. businesses and other organizations.

National Technical Information Service

NTIS provides the American public with permanent and ready access to scientific, technical, and business research through the acquisition, organization, and preservation of data added to its permanent collection. NTIS collects, classifies, coordinates, integrates, records, and catalogs scientific and technical information from whatever sources, foreign and domestic, that may stimulate innovation and discovery and then disseminates that information to the public. In an effort to provide the American public with increased access to the vast collection of government information, NTIS utilizes advanced e-commerce channels, including providing downloads of any item in its collection that is in electronic format for a single low fee or at no charge if under five pages. NTIS also helps other Federal agencies interact with and better serve the information needs of their own constituents by providing information management services.

Priorities/Management Challenges

NIST: Strategic Priorities for FY 2008

Based on long-term strategic planning efforts and an analysis of the most pressing needs related to the coming fiscal year, NIST senior leadership identified several key priorities in support of the Secretary's Policy Agenda for FY 2008. These are:

- **Competitiveness and Innovation: Use the President's American Competitiveness Initiative to help the United States to drive and take advantage of the increased pace of technological change.** The American Competitiveness Initiative (ACI) proposal will double funding for NIST's core programs over the next 10 years and thus increase Federal investment in critical research to ensure that the U.S. continues to lead the world in opportunity and innovation. NIST will continue to conduct high-priority research, identify technical measurement barriers to innovation, and transfer technical knowledge developed to the private sector as part of efforts to drive this initiative. Next-generation measurement and standards needs require NIST to focus its long-term research efforts on specific interdisciplinary technology areas where inadequate technical infrastructure is a barrier to innovation, commercialization, and public benefit, in particular in such areas as nanotechnology, enabling the hydrogen economy, and quantum science.

- **Trade: Maximize the value of free trade agreements and advance the interests of American business in key developing markets.** NIST will foster more efficient transactions in the domestic and global marketplace through more effective development and use of standards. As NIST expands its

research efforts with the private sector and other government agencies, it will work to improve the ways in which standards are used to support U.S. innovation and industrial competitiveness. Additionally, as part of the Department's Standards Initiative, NIST will continue to implement recommendations from the Department's May 2004 report, "Standards and Competitiveness: Coordinating for Results, Removing Standards-Related Trade Barriers Through Effective Collaboration." NIST will work to more effectively represent U.S. interests in selected areas of global standards and develop a more strategic approach for NIST's involvement in the standards process, including international standards affecting trade.

- **China: Promote U.S. trade and economic interests in our relations with China.** NIST will engage China in the formal international standards and measurement systems to minimize the need for China to develop its own unique national standards. In addition, NIST will establish cooperative efforts with China in targeted science and technology areas, addressing metrology and related standards needs of both the U.S. and China, with an emphasis on standards developed through an open, transparent, consensus process. In the process, NIST will build crucial peer-to-peer contacts to provide early understanding of Chinese strategic objectives in the standards and metrology arenas, thereby enabling an appropriate U.S. response. In collaboration with other agencies of the Department, NIST will support access to Chinese markets for U.S. companies by working to identify and remove potential technical barriers to trade, posed either by planned regulations, proposed standards, or conformity assessment activities.

- **Gulf Coast Recovery: Assist in the rebuilding of the Gulf Coast economy and place the region on a path to become stronger than it was before the 2005 hurricane season.** NIST will continue to recommend improvements to building and infrastructure standards for cost effectively reducing the loss of life and property damage due to natural and man-made hazards. These recommendations are based on NIST's expertise in developing the scientific basis required to enable technology innovations, improve prediction capabilities, and improve codes and standards. In particular, NIST will focus its efforts on disaster resilient structures and communities.

- **Environmental Stewardship: Advance market-driven, scientifically sound environmental stewardship.** NIST will continue its efforts to improve the accuracy and reliability of global climate change predictions and data by providing the necessary measurement science and standards. The ability to predict climate change rests on the accuracy of atmospheric measurements and on knowledge of basic properties of atmospheric constituents. Working in collaboration with other agencies, NIST will address critical gaps in climate change science that are limiting long-term climate policy decision-making.

- **Improve NIST's Facilities and Infrastructure:** As science and technology advances, the need for more sophisticated and demanding measurement science and standards grows. NIST can develop and provide these challenging capabilities and services only in environmentally stable and safe research and measurement laboratories. Many NIST laboratory facilities are decades old and are no longer capable of providing the stable research environment needed to efficiently conduct the advanced measurement research in many crucial areas including nanotechnology and quantum science. To fulfill its mission requirements, NIST must invest in a new high-performance laboratory at its Boulder site as well as critical improvements in its Gaithersburg facilities, including the expansion of the NIST Center for Neutron Research.

NTIS: Strategic Priorities for FY 2008

NTIS' priority is to contribute successfully to the Department of Commerce's strategic goal of promoting U.S. innovation and industrial competitiveness through improved productivity, quality, dissemination, and efficiency of research. To that end, NTIS is committed to increasing the number of new items it makes available, increasing the number of information products disseminated annually and enhancing customer satisfaction.

Unit Cost and Efficiency Measures

NIST

The FY 2005 PART assessment of the NIST Laboratories noted that "R&D-performing organizations typically cannot provide unit cost measures of efficiency due to the long timeframe for research, multivariate inputs, and diverse sets of outputs that derive from R&D activities."

In FY 2006 Hollings MEP developed an efficiency measure for client reported impact per million dollars of Federal investment over time. This is calculated by multiplying the average bottom-line client impact times the number of clients served per million dollars of Federal investment. Bottom-line client impact is defined as 15% of new and retained sales plus cost savings, avoidance of unnecessary investments, and savings on investments made as reported by Hollings MEP clients.

	FY 2003	FY 2004	FY 2005	FY 2006 Target	FY 2006	FY 2007 Target[1]	FY 2008 Target[1]
Ratio of Impact to Federal Investment (Bottom-line client impact divided by Federal investment)	12.3	13.2	20.9	11.1	Available 12/2007	4.8	4.0

[1] FY 2007 and FY 2008 impact ratios are based on a reduced appropriation level of $46.3M for each year.

NTIS

NTIS' primary objective is to collect, disseminate, and preserve scientific and technical information. This valuable information is made available for distribution in a variety of formats designed to accommodate customers' needs. The average cost to disseminate this information to the public is reflected in the unit cost measure below.

	FY 2004	FY 2005	FY 2006	FY 2007 Target	FY 2008 Target
Unit cost to disseminate an information product	$1.06	$.96	$.86	$.85	$.84

PART Assessment

NIST

- **NIST Laboratory Program** – the 2003 PART assessment of the NIST Laboratories for the FY 2005 budget cycle found the Laboratories "effective."
- **Hollings Manufacturing Extension Partnership** – the 2002 PART assessment for the FY 2004 budget cycle found Hollings MEP "moderately effective."

Status of Implementing PART Recommendations:

Program	OMB Recommendation	Milestones	Milestone Target	Status
NIST Laboratory Program	1. Investing in research in key technologies to support new measurement requirements important for the U.S. economic and scientific infrastructure. 2. Investing in facility improvements at NIST Labs to sustain the program's strong research capability.	N/A	N/A	1. The President's American Competitiveness Initiative (ACI) includes several initiatives for further development of essential technologies, including quantum information science, biometrics, cyber security, and nanotechnology. 2. The ACI includes a facility improvement-related initiative that addresses the most pressing facility aging and obsolescence issues facing NIST. NIST is engaged in a long-range facility modernization program to make badly needed repairs and upgrades to its physical plant. The ACI also includes substantial increases for the NIST Center for Neutron Research and NIST facilities at Brookhaven's National Synchrotron Light Source.
Hollings Manufacturing Extension Partnership	1. Provide $46.3 million for Hollings MEP. 2. Focus funding based on centers' performance and need. 3. Move ahead with plans to implement Next Generation MEP, with a greater emphasis on technology-based innovation services.	N/A	N/A	1. The FY 2006 President's budget proposal to reduce the Hollings MEP to $46.8 million was not enacted. 2. Hollings MEP has implemented a Center Performance Management process to direct funding based on performance. Each center must meet certain performance thresholds to maintain an Acceptable Performance rating. Unacceptable performance results in a four part probation period. If after a specified period of time in probation, the results of the client survey indicate that the center does not meet the requirements, the result is re-competition of the funding. 3. In FY 2006, MEP developed a Next Generation strategic plan. MEP is encouraging the Hollings MEP Centers to transition to engaging U.S. manufacturers in longer-term technology-intensive innovation services. Work will continue to implement this plan in collaboration with state partners.

NTIS

A PART assessment for NTIS has not been conducted.

FY 2008 Program Changes

The FY 2008 budget request reflects the challenges facing the Nation's technological infrastructure and the resources needed to directly contribute to the Department's strategic goals of promoting U.S. innovation and industrial competitiveness by protecting intellectual property, enhancing technical standards, and advancing measurement science; and providing the information and tools to maximize U.S. competitiveness and enable economic growth for American industries, workers, and consumers.

		Base		Increase/Decrease	
	Name of Program	**FTE**	**Amount ($M)**	**FTE**	**Amount ($M)**
National Institute of Standards and Technology	**NIST Laboratories**	**2,797**	**$668.4**	**39**	**$72.4**
	Hollings Manufacturing Extension Partnership	**42**	**$46.4**	**0**	**$0**
National Technical Information Service	**National Technical Information Service**	**200**	**$41.5**	**0**	**$0**

Note: Dollar amounts reflect total obligations; base FTE include reimbursable FTE.

Target and Performance Summary

NIST Performance Goal 1: Promote innovation, facilitate trade, and ensure public safety and security by strengthening the Nation's measurement and standards infrastructure

	FY2003 Actual	FY2004 Target	FY2004 Actual	FY2005 Target	FY 2005 Actual	FY2006 Target	FY2006 Actual	FY2007 Target	FY2008 Target
Qualitative assessment and review of technical quality and merit using peer review	Completed	Complete	Completed	Complete	Completed	Complete	Completed	Complete	Complete
Citation impact of NIST-authored publications	New	New	New	New	New	New	New	>1.1	>1.1
Peer-reviewed technical publications	1,267	1,300	1,070	1,100	1,148	1,100	1,163	1,100	1,100
Standard Reference Materials sold	29,527	29,500	30,490	29,500	32,163	30,000	31,195	30,000	31,000
NIST-maintained datasets downloaded	55,653,972	56,000,000	73,601,352	80,000,000	93,000,000	80,000,000	94,000,000	80,000,000	85,000,000
Number of calibration tests performed	13,987	New	12,503	New	12,849	New	13,127	12,000	12,000

NIST Performance Goal 2: Raise the productivity and competitiveness of small manufacturers

	FY2003 Actual	FY2004 Target[1]	FY2004 Actual[2]	FY2005 Target	FY 2005 Actual	FY2006 Target[5]	FY2006 Actual	FY2007 Target[6]	FY2008 Target[6]
Number of clients served by Hollings MEP Centers receiving Federal funding	18,422	6,517	16,090	16,640	16,448[3]	16,440	Available 12/2007	8,183	6,879
Increased sales attributed to Hollings MEP Centers receiving Federal funding	$1,483M	$228M	$1,889M	$591M	$2,842M[4]	$591M	Available 12/2007	$291M	$244M
Capital investment attributed to Hollings MEP Centers receiving Federal funding	$912M	$285M	$941M	$740M	$2,248M[4]	$740M	Available 12/2007	$364M	$306M
Cost savings attributed to Hollings MEP Centers receiving Federal funding	$686M	$156M	$721M	$405M	$1,304M[4]	$405M	Available 12/2007	$199M	$167M

[1]FY 2004 targets are based on the FY 2004 Consolidated Appropriations bill, which included an annual level for Hollings MEP of $39.6M (which, less recessions, netted $38.7M).

[2]Due to the funding cycle of Hollings MEP Centers the Hollings MEP system was able (on a one-time basis) to manage the funding decrease in FY 2004 with minimal impact to actual Center funding levels. The Hollings MEP system would not be able to sustain the current number of centers in the event of future funding cuts of a similar nature.

[3]The number of clients served reflects 99% of the expected number; this is due to MEP encouraging the Centers to transition to engaging U.S, manufacturers in longer-term, technology intensive innovative services.

[4]FY 2005 targets were discounted based on anticipated disruptions in the Hollings MEP system due to the reduced funding received in FY 2004. However, the funding cycle of Centers allowed the Hollings MEP system (on a one-time basis) to manage the funding decrease in FY 2004 with minimal impact to actual Center funding levels and as result, FY 2005 impacts have exceeded the planned targets.

[5]FY 2006 targets are based on an appropriation of $104.6M. The FY 2006 target for number of clients served was revised based on preliminary estimates of actual number of clients served in FY 2005; the remaining measures are directly tied to the number of clients served.

[6]FY 2007 and FY 2008 targets are based on an appropriation of $46.3M for each year. The decrease in targets between FY 2007 and FY 2008 reflects the impact from a recompetition of the MEP centers and is consistent with executing the Next Generation MEP strategy. In FY 2008, the new subset of MEP centers would be solely focused on innovation and technology deployment. The change in service offerings coupled with the lead time necessary to measure the effects of MEP innovation services would result in reduced impacts.

NTIS Performance Goal 1: Increase public access to worldwide scientific and technical information through improved acquisition and dissemination activities

	FY2003 Actual	FY2004 Target	FY2004 Actual	FY2005 Target	FY 2005 Actual	FY2006 Target	FY 2006 Actual	FY2007 Target	FY2008 Target
Number of Updated Items Available (Annual)	530,910	525,000	553,235	530,000	658,138	660,000	673,807	665,000	675,000
Number of Information Products Disseminated (Annual)	29,134,050	18,000,000	25,476,424	25,800,000	26,772,015	27,000,000	30,616,338	27,100,000	27,250,000
Customer Satisfaction	97%	98%	96%	95% - 98%	98%	95% - 98%	98%	95% - 98%	95% - 98%

Skill Summary:

At the end of FY 2006, the staffs of the component bureaus reflected the following levels of educational attainment:

- Total NIST staff included 32% Ph.D., 15% M.A. or M.S., and 19% B.A. or B.S. holders. The breakdown of professional staff by major NIST organization was:
  - NIST Laboratories: 60% Ph.D., 18% M.A. or M.S., 17% B.A. or B.S. holders
  - Hollings Manufacturing Extension Partnership: 40% M.A. or M.S., 20% B.A. or B.S. holders
  - Baldrige National Quality Program: 22% Ph.D., 45% M.A. or M.S., 22% B.A. or B.S. holders
- Total NTIS staff included 7% M.A. or M.S. and 23% B.A. or B.S. holders.

Resource Requirements Summary

Dollars in Millions. Funding amounts reflect total obligations.
Information Technology (IT)
Full Time Equivalent (FTE)

NIST Laboratory Performance Goal: Promote innovation, facilitate trade, and ensure public safety and security by strengthening the Nation's measurement and standards infrastructure

	FY 2003 Actual	FY 2004 Actual	FY 2005 Actual	FY 2006 Actual	FY 2007 Estimate	FY 2008 Base	Increase/ Decrease	FY 2008 Estimate
Total Funding	614.2	576.9	621.6	762.2	649.7	668.4	72.4	740.8
IT Funding	67.5	63.1	65.6	65.9	69.0	71.1	0.0	71.1
FTE	2,725	2,672	2,503	2,550	2,675	2,797	39	2,836

NIST Hollings MEP Performance Goal: Raise the productivity and competitiveness of small manufacturers

	FY 2003 Actual	FY 2004 Actual	FY 2005 Actual	FY 2006 Actual	FY 2007 Estimate	FY 2008 Base	Increase/ Decrease	FY 2008 Estimate
Total Funding	111.3	46.9	102.7	111.9	95.4	46.4	0.0	46.4
IT Funding	2.6	1.5	1.0	1.0	0.9	0.9	0.0	0.9
FTE	89	68	71	67	64	42	0	42

NTIS Performance Goal: Increase public access to world wide scientific and technical information through improved acquisition and dissemination activities

	FY 2003 Actual	FY 2004 Actual	FY 2005 Actual	FY 2006 Actual	FY 2007 Estimate	FY 2008 Base	Increase/ Decrease	FY 2008 Request
Total Funding	27.7	19.2	15.9	27.2	51.1	41.5	0.0	41.5
IT Funding	5.7	5.4	3.5	3.9	4.0	4.0	0.0	4.0
FTE	181	165	157	144	200	200	0	200

Grand Total[1]	FY 2003 Actual	FY 2004 Actual	FY 2005 Actual	FY 2006 Actual	FY 2007 Estimate	FY 2008 Base	Increase/ Decrease	FY 2008 Request
Total Funding	952.8	830.1	878.5	973.9	822.0	762.4	72.4	834.8
IT Funding	81.1	72.1	72.3	72.3	73.9	76.0	0.0	76.0
FTE	3,242	3,109	2,938	2,896	3,000	3,069	39	3,108

[1]Includes funding and FTEs associated with the Advanced Technology Program.

FY 2008 Program Increases:

Program Initiatives	Funding Request	Anticipated Impact	Location in the Budget
Building 1 Extension	$28M	NIST proposes to construct a unique, high-performance laboratory space with stringent control of temperature, vibration, humidity, and air quality at its Boulder site. This facility will provide the measurement infrastructure essential for scientific progress and technical innovation in the 21st century.	Construction of Research Facilities Appropriation; Construction and Major Renovations Activity
NIST Center for Neutron Research (NCNR) Expansion and Reliability Improvements	$19M	This initiative will continue to fund the expansion of the NCNR, including the construction costs of a new guide hall and supporting facilities. This expansion will provide for an additional 500 research participants and 75 more technical publications per year.	Construction of Research Facilities Appropriation; Construction and Major Renovations Activity
Enabling Nanotechnology from Discovery to Manufacture	$6M	Through the new NIST Center for Nanoscale Science and Technology (CNST) and the NIST Laboratory programs, NIST will enable science and industry by providing essential measurement methods, instrumentation, and standards to support all phases of nanotechnology development, from discovery to production.	Scientific and Technical Research and Services Appropriation; NIST Laboratories Activity
Enabling Innovation Through Quantum Science	$4M	NIST will enhance its Nobel-prize winning work by pushing the limits of scientific understanding in the quantum realm, and building advanced tools and techniques to measure and manipulate nature's smallest particles.	Scientific and Technical Research and Services Appropriation; NIST Laboratories Activity
Measurements and Standards for the Climate Change Science Program	$5M	In collaboration with other agencies, NIST will address critical gaps in climate change science that are limiting long-term climate policy decision-making. Fulfilling these objectives will help the Nation adapt to global climate change by improving the accuracy of climate predictions.	Scientific and Technical Research and Services Appropriation; NIST Laboratories Activity
Disaster Resilient Structures and Communities	$4M	This program proposes to develop the scientific basis required to enable technology innovations, improve prediction capabilities, and improve codes and standards for cost effectively reducing loss of life and property damage due to natural and man-made hazards.	Scientific and Technical Research and Services Appropriation; NIST Laboratories Activity
National Earthquake Hazards Reduction Program Initiative	$3.25M	There are close to $8.6 trillion of structures and 75 million people located in urban areas of moderate to high earthquake risk. This initiative will fund research for advanced mitigation technologies and create guidelines for the rehabilitation of existing structures.	Scientific and Technical Research and Services Appropriation; NIST Laboratories Activity

Note: The program changes for the NIST Laboratory Programs represent specific "projects" or research areas NIST will develop in support of the Nation's technical infrastructure. While these projects link directly to the goals of the NIST Laboratory Programs, progress and performance is measured at the individual project level through milestone tracking of major project outputs, such as those described in the budget narratives. Without funding, those outputs will be forgone along with the associated benefits (i.e., outcomes) described in each narrative.

NIST Performance Goal 1: Promote innovation, facilitate trade, and ensure public safety and security by strengthening the Nation's measurement and standards infrastructure.

Corresponding DOC Strategic Goal and Objective:

Strategic Goal 2: Promote U.S. innovation and industrial competitiveness by protecting intellectual property, enhancing technical standards, and advancing measurement science.

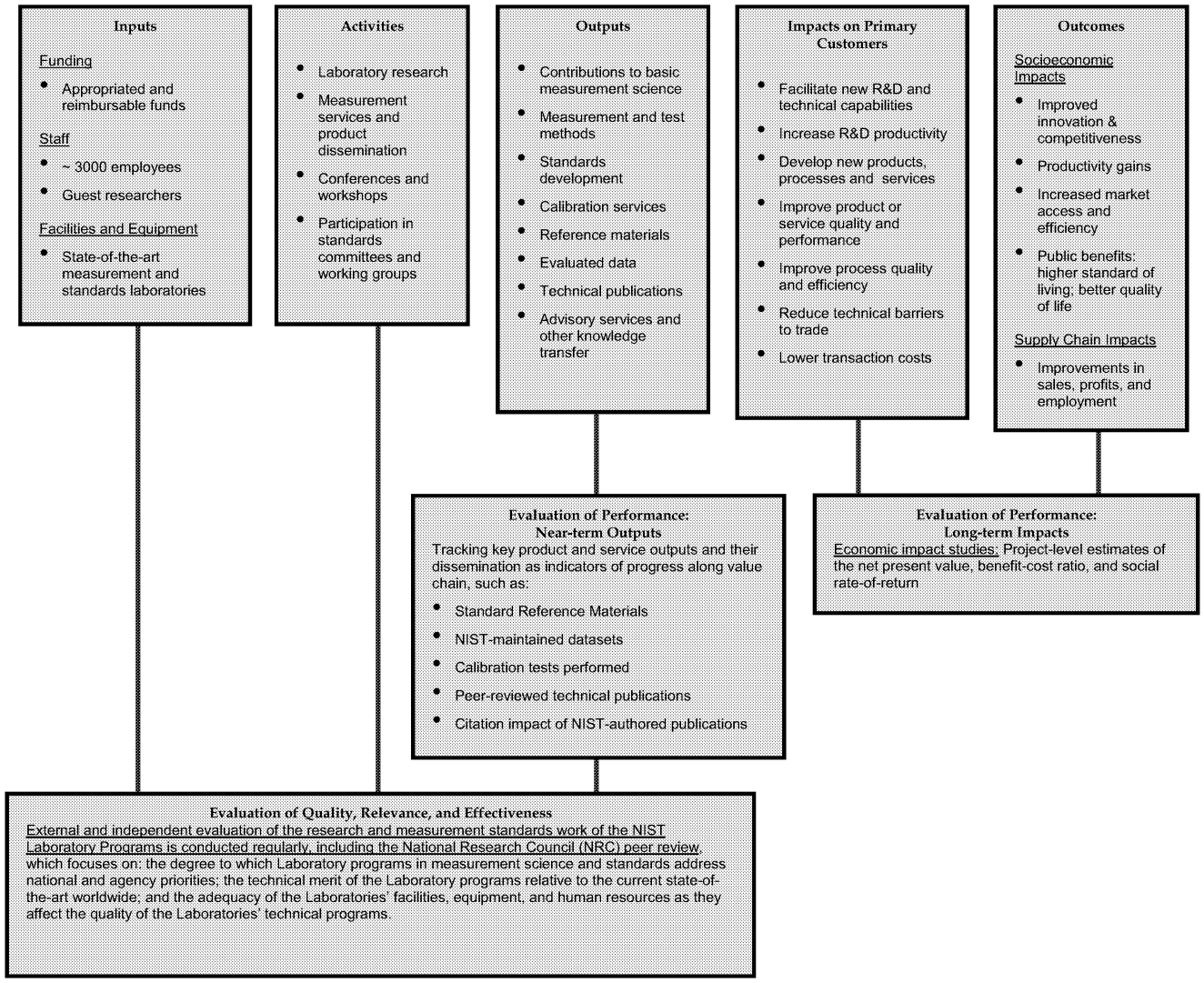
General Goal/Objective 2.1: Develop measurement science and standards tools and capabilities that help the United States to drive and take advantage of the increased pace of technological change.

Rationale for Performance Goal:

As the National Measurement Institute for the United States, NIST is uniquely responsible for establishing and maintaining an efficient system that links the fundamental units of measurement to the measurement methods used by industry, universities, and other government agencies. The Nation's ability to innovate, and grow relies on a robust scientific and technical infrastructure – including the measurement science, standards, and technology provided by the NIST Laboratories. The NIST Laboratories perform research to develop the measurement tools, data, and models for advanced science and technology. The model below depicts the NIST Laboratory Program's value-creation chain – from inputs like funding and staff to outcomes like productivity gains and improved quality of life. The model also includes the methods and measures used to evaluate quality, relevance, and performance along the impact path, each of which is described in more detail in the sections that follow.

NIST has designed its performance evaluation system to accommodate the organization's unique mission and impact path as well as to respond to the intrinsic difficulty of measuring the results of investments in science and technology. Like other Federal science organizations, the primary output of NIST's laboratory research is scientific and technical knowledge, which is inherently difficult to measure directly and comprehensively. In addition, the outcomes from research often do not begin to accrue until several years after the research program has been completed, and the diffusion of benefits often affects broad segments of industry and society over long time periods. Given these challenges, the NIST Laboratory Program evaluates its performance using an appropriate mix of specific output tracking, peer review, and economic impact analyses. Together, these evaluation tools, combined with continual feedback from customers, provide NIST management and external stakeholders with a comprehensive picture of performance towards its long-term goals.

NIST Laboratory Program: Impact and Evaluation Logic Model



Measure 1a: Qualitative assessment and review of technical quality and merit using peer review

Explanation of Performance Measure:

External and independent evaluation of the research and measurement standards work of the NIST Laboratory Programs is conducted regularly. This type of peer review, combined with quantitative evaluation metrics focused on dissemination of NIST's measurements and standards work, demonstrate the laboratories' contribution to the Nation's measurement and standards infrastructure.

In FY 2006, a JILA* External Review Committee, created by the University of Colorado, conducted a four-day, in-depth review of the operations and scientific activities of JILA. JILA is one of the Nation's leading research institutions in the physical sciences and is jointly operated by NIST and the University of Colorado. The review committee consisted of representatives from universities across the country and NIST staff. The committee was unanimously impressed by the overall high quality of scientific research and organizational management at JILA, and concluded that "JILA is truly a unique organization that blends the research cultures of a university and a government laboratory in ways that lead to synergistic and innovative approaches to…challenging scientific problems."

Since 1959, the NIST Laboratories have been reviewed by the National Research Council (NRC). The NRC review is independent, technically sophisticated, and extensive. The assessment process focuses on the quality, relevance, and technical merit of the NIST Laboratories Program to ensure it is developing and promoting the infrastructure tools and measurement standards needed by industry, academia, and other government agencies.

NIST has worked with the NRC to restructure the review process. Beginning in FY 2007, the NRC will direct a biennial assessment process where half of the NIST Laboratories will be reviewed each year. This restructuring will promote increased technical exchange between NIST scientists and the expert review panels (one for each of the NIST Laboratories), and will result in individual reports for each Laboratory. The reports will be based upon an in-depth on-site review and will pay particular attention to the following factors, as charged by the NIST Director:

- The degree to which Laboratory programs in measurement science and standards address national and agency priorities;
- The technical merit of the Laboratory programs relative to the current state-of-the-art worldwide; and
- The adequacy of the Laboratories' facilities, equipment, and human resources as they affect the quality of the Laboratories' technical programs.

The NRC's latest assessment report published in January 2006 is available at http://www.nist.gov/director/AssessmentReport.pdf. The table below provides summary statements for the laboratories excerpted from this report.

*JILA is not an acronym, but the name of the Institute established at the University of Colorado as a joint institute between the University and NIST.

Sample Statements from NRC Peer Review

Electronics and Electrical Engineering (EEEL)	"The overall technical quality of EEEL continues to be very high and innovative. The EEEL has an outstanding staff, a solid history of achievement, and close ties to customers. The projects are generally well aligned with the NIST mission and provide an excellent value for the money to the country and its industrial infrastructure…. Metrology, though recognized as NIST's core competency, is being seriously compromised in recent years, particularly through funding competition with the Strategic Focus Areas. The EEEL should undertake a conscientious reexamination of this trend in order to reach a clear decision about the laboratory's level of commitment to metrology and to develop a strategy for implementing the decision." (p. 62).
Manufacturing Engineering (MEL)	"All MEL divisions for the most part are doing excellent technical work. For the programs evaluated, the divisions demonstrated that their activities were focused on those programs determined most essential to the mission of MEL and NIST. In some cases… projects had reached the stage of needing reevaluation and redirection on the basis of work being done elsewhere and shifts in priorities. Adjustments in assignments will continue to be a key activity of MEL management, to ensure that projects are properly concluded and new ones are started in a logical manner." (pp. 59-60).
Chemical Science and Technology (CSTL)	"The CSTL is truly a national resource, conducting outstanding research to support the continued development of a wide range of measurement capabilities, providing critical and reliable chemical and physical properties data and essential reference standards. Its work spans the entire scientific spectrum, from fundamental physics through chemistry and into biology, and supports an astonishingly diverse group of industries. The quality of the scientific staff is superb, and the laboratory has undergone a rather dramatic transformation over the past decade or so to become entrepreneurial and customer-focused while being mindful to maintain and advance its core competencies." (p. 30).
Physics (PL)	"During the assessment period there has been excellent progress in the development and advancement of optical standards, an area in which NIST excels…. A challenge faced by the Physics Laboratory is the need to retain and recruit high-profile scientists who are in demand by universities or industry….. In general, the relevance of the work in all divisions of the Physics Laboratory is high to very high." (pp. 80, 84).
Materials Science and Engineering (MSEL)	"The MSEL has impressive programs of very high quality and technical merit as well being both relevant and effective…. The MSEL fulfills its NIST mission well, and effectively disseminates information through the production of Standard Reference Materials (SRMs), Recommended Practice Guides, and databases….[The NIST Center for Neutron Research's] internal science program covers an impressive range with excellent depth. Good topics are pursued with highly visible results, and many problems addressed have technological interest. " (pp. 69, 70).
Building and Fire Research (BFRL)	"In the past 2 years, BFRL has had an outstanding record of service to the country…. The BFRL was very active during the past 2 years, to a large extent because of the extra burdens of major research for the country on the WTC [World Trade Center] investigations and the application of new and developed procedures for the determination of contaminant spread in buildings. The WTC activities, along with the investigation of the fire at The Station nightclub in Rhode Island, represent the first two official investigations carried out under NCSTA [National Construction Safety Team Act of 2002]. The excellent manner in which these investigations were carried out is a highlight of this period for BFRL and an example of the ability of this laboratory to marshal expertise, both from in-house and from outside consultants, and to manage such investigations in a fully professional manner." (p. 18).
Information Technology (ITL)	"The Information Technology Laboratory ranks with the best of the U.S. government laboratories in the quality and merit of its technical work. The technical quality of the work is uniformly very high across all six divisions…. The projects reviewed generally evinced high technical quality because of the caliber of the scientists, the significant accomplishments in the work, and the collaboration with other scientists enabling breakthrough work that could not be done in isolation." (p. 53).

Measure 1b: Citation impact of NIST-authored publications

Within the scientific community, citation rates are often used to measure the demand for or relevance of published research. Citation analysis also provides an independent and objective validation of peer review findings as research has shown that high citation rates – the cumulative number of citations per publication – correlate with peer review judgment in terms of scientific quality and relevance. Citation rates, when combined with other metrics such as publication counts,

provide a useful measure of the utility and relevance of NIST's research and illustrate the increased dissemination of the scientific knowledge and technical standards that support innovation, productivity improvements, and overall quality of life improvements.

NIST assesses its citation impact with data collected by Thomson Scientific, formerly the Institute for Scientific Information (ISI), which has been collecting research publication data for more than 40 years and now maintains one of the most comprehensive sources of available publication data for scientific and technical organizations. This measure represents NIST's "relative citation impact" - that is, the average citation rate per NIST publication relative to Thomson's Scientific's baseline citation rate number for all scientific and technical organizations. For this measures, the relative citation impact covers all citations of papers published in the last five years (e.g., the 2007 citation impact will cover the 2003-2007 time frame) as reported by Thomson Scientific. In addition, according to Thomson Scientific's *Essential Science Indicators,* NIST is ranked number one for the top ten most-cited publications among U.S. Government institutes in the field of materials science from January 1996 - April 30, 2006.[1]

FY 2007 and 2008 Targets: NIST's relative citation impact for the past 25 years (1981-2005) has been consistently above average. These data demonstrate that NIST consistently produces relevant scientific and technical publications, and NIST expects the past trend of above average relative citation impact on its peer-reviewed publications to continue. This measure, which was discontinued in FY 2004 to reduce the overall number of NIST performance measures, will be reestablished as a NIST GPRA measure starting in FY 2007. Citation impact reflects the utility and relevance of NIST research and is outcome-oriented.

Measure 1c: Peer-reviewed technical publications

Technical publications represent one of the major mechanisms NIST uses to transfer the results of its research to support the nation's technical infrastructure and provide measurements and standards – vital components of leading-edge research and innovation – to those in industry, academia, and other government agencies. Each year, NIST's technical staff produces a total of 2,000 to 2,200 manuscripts and publications with approximately 50-60 percent appearing in prestigious scientific peer-reviewed journals. A peer-reviewed journal is a publication in which articles are formally reviewed by the journal's editors and/or a panel of experts and respected researchers in a specific field of study before being accepted for publication.

This measure is a direct count of NIST technical manuscripts that have been published in an elite body of influential scientific peer-reviewed journals as compiled in the *Web of Science*® bibliographic database maintained by Thomson Scientific, formerly the Institute for Scientific Information (ISI). Thomson Scientific has been collecting research publication data for more than 40 years and now maintains one of the most comprehensive sources of available publication data for scientific and technical organizations. This measure reflects in part the quality and demand for NIST publications.

In addition to peer-reviewed journals, NIST publishes its measurement methods and standards through conference proceedings, NIST interagency reports, and special publications. For example, the NIST Journal of Research highlights NIST's research and development in the area of metrology and related fields of physical science, engineering, chemistry, applied mathematics, statistics, biotechnology, and information technology. Also, special publications such as NIST Recommended Practice Guides target specific industries and provide users with valuable guidance on specialized measurement techniques and methods for interpreting results.

[1] "U.S. Government Research Facilities: How in the World Do They Compare?," *Science Watch*®, Vol 17, No. 5, September/October 2006, pp. 1-2.

FY 2007 and FY 2008 Targets: The data collection process for this measure has been improved to more accurately and efficiently reflect the number of NIST technical publications that are published in peer-reviewed journals in a fiscal year. In previous years, this data was derived from a direct count of NIST technical manuscripts that were reviewed and approved for publication in peer-reviewed journals by the NIST Editorial Review Boards as well as the number of approved manuscripts actually published in peer-reviewed journals for that fiscal year. This process was time-consuming since it involved the tracking of individual manuscripts from the review stage to the actual publication date. Beginning in FY 2007, this measure is a direct count of NIST technical manuscripts that have been published in an elite body of influential peer-reviewed journals as compiled in the *Web of Science*® bibliographic database maintained by Thomson Scientific. This measure was adopted in FY 2005 to better reflect the quality and demand for NIST research results and standards services. While NIST expects to produce a consistent number of technical publications peer-reviewed publications over time, target estimates may need to be adjusted once additional trend data are available.

Measure 1d. Standard Reference Materials (SRMs) sold

Standard Reference Materials are the definitive source of measurement traceability in the United States; all measurements using SRMs can be traced to a common and recognized set of basic standards that provides the basis for compatibility of measurements among different laboratories. SRMs are certified in the NIST Laboratories for their specific chemical and material properties. Customers use SRMs to achieve measurement quality and conformance to process requirements that address both national and international needs for commerce and trade and public safety and health. For example, NIST recently developed a new SRM that will help the petroleum industry meet new Environmental Protection Agency regulations for sulfur levels in diesel fuel.

FY 2007 and 2008 Targets: This measure represents a direct count of the number of SRM units sold to customers in industry, academia, and other government agencies. Recent trends illustrate a high (roughly 30,000 per year) and slightly increasing number of SRMs disseminated annually. Recent increases are due to restoration of key SRMs to inventory. NIST expects this trend to stabilize over time, resulting in a consistent number of SRMs disseminated annually. The FY 2008 target aims for an increase in SRMs disseminated, but may be revised based on the trend indicated by FY 2006 and FY 2007 outcomes.

Measure 1e. Downloads of NIST-maintained datasets

NIST provides online access to over 80 scientific and technical databases. These databases cover a broad range of substances and properties from a variety of scientific disciplines. Some datasets – such as the NIST Chemistry WebBook, NIST Physical Reference Data Systems, and the NIST Ceramics WebBook – are comprehensive and contain a large number of databases, while others serve very specific applications. NIST's online data systems are heavily used by industry, academia, other government agencies, and the general public and represent another method NIST uses to deliver its measurements and standards tools, data, and information. This measure is a direct count of the annual number of downloads of NIST-maintained data. While this count demonstrates a very high level of data dissemination, it does not capture the distinct number of users that have accessed the databases (NIST cannot and does not collect user-specific data on web transactions).

FY 2007 and FY 2008 Targets: While over time NIST expects a consistent level of online data dissemination, it is difficult to develop long-term target estimates without additional trend data, and FY 2007 and FY 2008 targets may need to be adjusted.

Measure 1f. Number of calibration tests performed

NIST offers more than 500 different types of physical calibrations in areas as diverse as radiance temperature, surface finish characterization, and impedance. NIST calibration services and special tests are characterizations of particular instruments, devices, and sets of standards with respect to international and national standards. NIST calibration services provide the customer with direct traceability to national and international primary standards. This measure illustrates the quantity of physical measurement services provided by NIST for its customers, including calibration services, special tests, and Measurement Assurance Programs (MAPs). MAPs are quality control programs for calibrating entire measurement systems.

The output data represent a direct count of calibration tests performed. The data provide information on service output levels only and represent a measure of throughput but not workload per se, as the time and calibration effort required can vary substantially across calibration tests. As with SRMs and NIST-maintained datasets, downstream impact is a function of the nature of individual calibration services provided more than the sheer volume of tests performed.

FY 2007 and FY 2008 Targets: This measure has been adjusted to better demonstrate the level of calibration output. NIST has moved from reporting the number of items calibrated to reporting the number of tests performed in a given fiscal year. FY 2007 represents the first year NIST will begin formally reporting progress on this measure; however, historical data have been provided. While the annual demand for calibrations can fluctuate due to several factors outside NIST's control, including improvements in measurement technology that lessen the need for frequent calibrations, improved leverage in the marketplace where NIST provides calibrations to secondary service providers, consolidation of calibration activities within large R&D organizations, and industry consolidation (as, for example, in defense-related industries), NIST expects to perform a consistent number of calibrations annually. The FY 2008 target aims for consistent number of calibration tests performed, but may be revised based on the trend indicated by FY 2006 and FY 2007 outcomes.

Program Evaluation:

Visiting Committee on Advanced Technology

The programmatic goals and strategic direction of NIST as a whole are reviewed regularly by the Visiting Committee on Advanced Technology (VCAT). Established by Congress in 1988, the VCAT functions solely as an advisory body in accordance with the provisions of the Federal Advisory Committee Act. Comprised of distinguished individuals with diverse backgrounds from industry and academia, the VCAT provides a representative cross-section of traditional and emerging technologies.

NIST Visiting Committee on Advanced Technology (VCAT) FY 2006 Membership		
Dr. Thomas M. Baer Executive Director, Stanford Photonics Research Center, Stanford University	Ms. Deborah L. Grubbe, P.E., Chair Vice President, Group Safety and Industrial Hygiene, BP	Dr. John F. Cassidy Ret. Senior Vice President, Science & Technology, United Technologies Corporation
Dr. Paul A. Fleury Dean of Engineering & Frederick W. Beinecke Professor of Engineering and of Applied Physics, Yale University	Dr. E. David Spong, Vice Chair Retired President, Integrated Defense Systems, The Boeing Company	Dr. Lou Ann Heimbrook Vice President of Global Operations, Merck Research Laboratories, Merck & Co. Inc.
Dr. Donald B. Keck Retired Vice President, Research Director, Corning Incorporated	Mr. Gary D. Floss Director, Quality Assurance & Continual Improvement, Marvin Windows and Doors	Mr. Thomas A. Saponas Retired Senior Vice President & Chief Technology Officer, Agilent Technologies
Dr. James W. Serum President, SciTek Ventures	Mr. Edward J. Noha Chairman Emeritus, CNA Financial Corporation	Mr. W. Wyatt Starnes Chairman & CEO, SignaCert, Inc.
	Mr. Robert T. Williams Vice President Track-Type Tractors Division, Caterpillar Inc.	

In its most recent annual report, the VCAT commended NIST for "aggressively undertaking new strategic planning activities to help ensure that programs and investment strategies are better aligned with NIST's mission and national priorities." See http://www.nist.gov/director/vcat/index.htm for additional information on the VCAT, including its most recent annual report.

Cross-cutting Activities:

Intra-Department of Commerce

- **NOAA:** NIST works with NOAA on the Federal Natural Disaster Reduction Initiative, which is focused on reducing the costs of natural disasters and saving lives through improved warnings and forecasts and information dissemination. Also, NIST and NOAA are among a group of Federal agencies focused on the global climate change initiative to accelerate new global observation technologies to improve the understanding of global climate change.
- **NTIA:** NIST and NTIA cooperate to support development of ultrawideband signal technology, a new wireless technology that will improve communications for emergency services and other applications.
- **ITA:** NIST has a long history of collaboration with ITA on technical barriers to trade. Currently, NIST & ITA are collaborating closely under the terms of the DOC Standards Initiative.

Other government agencies

NIST provides research and services in measurement and standards to almost every other agency in the Federal government with scientific missions contracted through specific Interagency Agreements or memoranda of understanding. NIST measurement research, services, and facilities have long contributed to national defense and security, to the nationwide safety and quality assurance systems that ensure the accuracy of health care measurements, to the accuracy of environmental measurements, and to law enforcement standards. NIST plays an essential role in a wide variety of intra-governmental and government–industry

coordination committees. For example, NIST has leadership positions on the committees, subcommittees, and working groups of the National Science and Technology Council (NSTC).

Private sector
NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life. As such, the NIST Laboratories have extensive and diverse interactions with industry, which provide an important source of information about the quality, direction, and future demand for NIST products and services. Many of the laboratories' primary outputs, such as Standard Reference Materials and calibration services, are critically important to the quality and cost efficiency of products and production processes throughout U.S. industry. In addition, the NIST staff use technical publications, conferences, and workshops as mechanisms to transfer the results of their work to the U.S. private sector that need cutting-edge measurements and standards.

External Factors and Mitigating Strategies:
Industry-specific business conditions and technological developments affect the level and range of demand for NIST products and services over time. In general, NIST seeks to mitigate the effects of external technological and market uncertainties by maintaining varied and close relationships with its customer base. Through conferences, workshops, technology roadmaps, and many other forms of interaction with its customers, NIST regularly evaluates and adjusts to the direction and level of demand for measurements, standards, reference data, test methods, and related infrastructural technologies and services.

NIST Performance Goal 2: Raise the productivity and competitiveness of small manufacturers.

Corresponding DOC Strategic Goal and Objective:
Strategic Goal 1: Provide the information and tools to maximize U.S. competitiveness and enable economic growth for American industries, workers, and consumers.

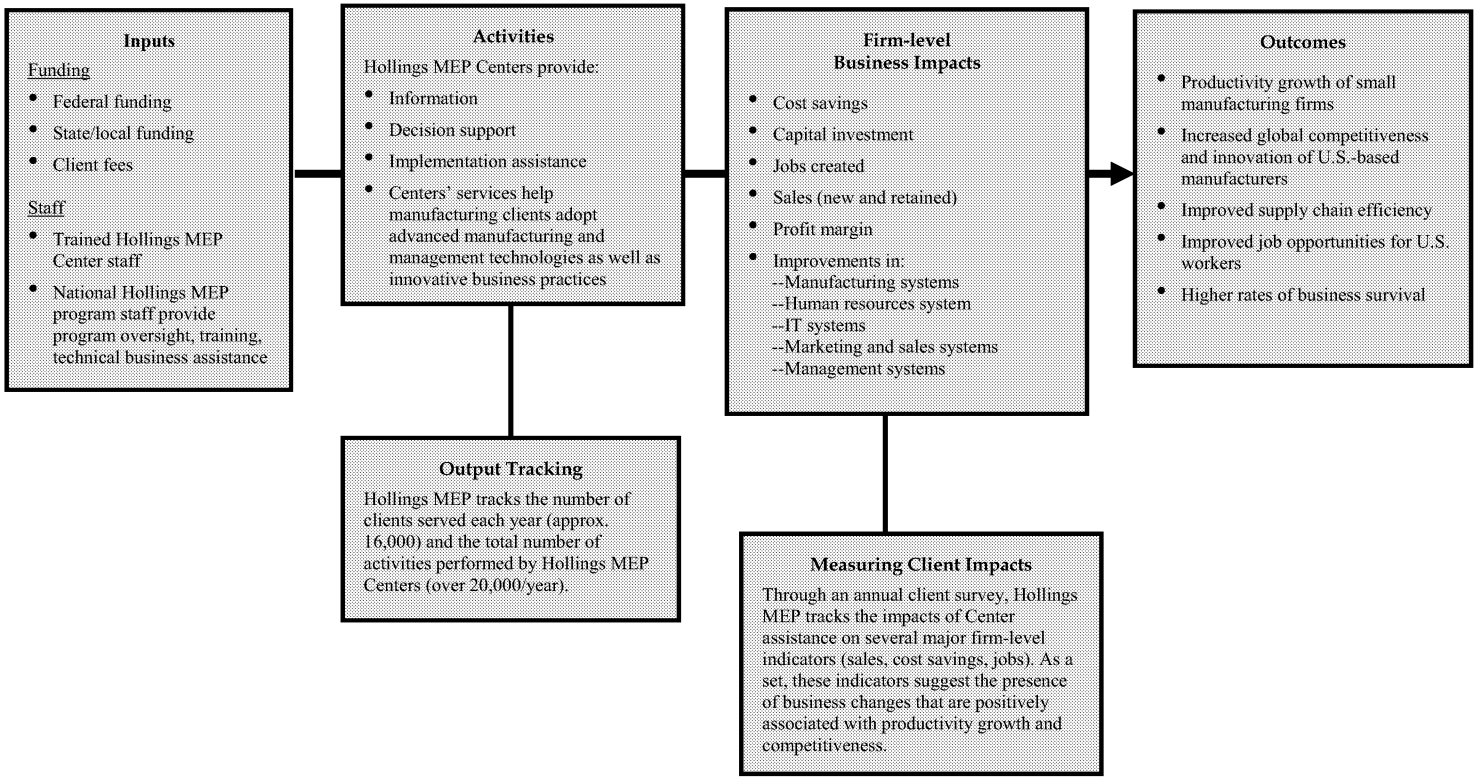
General Goal/Objective 1.4: Position small manufacturers to compete in a global economy

Rationale for Performance Goal:
Operating under the authority of 15 U.S.C. 278k, Hollings MEP is a federal-state-local partnership program that provides small U.S. manufacturers with access to manufacturing technologies, resources, and expertise. Through Hollings MEP's network of manufacturing centers, linked to state, university, community college, and private sources of technology and expertise, NIST helps smaller firms adopt advanced manufacturing and management technologies as well as innovative business practices to position them to compete in the global economy.

The Nation's approximately 350,000 small manufacturers employ over eleven million people providing intermediate parts and equipment that contribute more than half of the value of U.S. manufacturing production. Their role in manufacturing supply chains is crucial; and the Nation's future manufacturing productivity and competitiveness rests largely on the ability of these establishments to raise their efficiency, lower their costs, and implement a culture of innovation into their business operations. Hollings MEP helps companies transform themselves into high performance enterprises – productive, innovative, customer-driven, and competitive – by efficiently providing high value technical and advisory services, including access to industry best practices.

Hollings MEP's ultimate goal is to measurably improve the productivity and competitiveness of all its clients. The model below demonstrates the impact path (or value creation chain) of the Hollings MEP program – from inputs such as appropriated funds and staff to end-outcomes such as productivity improvements for the small manufacturing sector. In addition, the model also depicts how NIST measures the progress of the Hollings MEP program along its impact chain.

Hollings MEP's Impact Path and Evaluation Methods: Results-based Management for Advisory Services



Explanation of Performance Measures:

Hollings MEP's manufacturing assistance centers work at the grassroots level with each Hollings MEP center, providing local manufacturers with expertise and services tailored to their most critical needs. The program uses the measures below to demonstrate both a level of activity as well as the outcomes resulting from the services Hollings MEP Centers provide. As the program's emphasis shifts towards innovation and technology deployment in line with the Next Generation MEP strategy, MEP's performance evaluation system will be revised to align with program objectives.

Measure 2a. Number of clients served by Hollings MEP Centers receiving Federal funding

Hollings MEP works with the Nation's small manufacturing firms to provide assistance to overcome barriers to productivity growth and competitiveness. This measure represents the annual number of new and repeat clients served by Hollings MEP Centers who received training, technical, and business assistance ranging from informational seminars and training classes to in-depth technical assistance typically beginning with the implementation of lean enterprise concepts and progressing to strategic re-positioning and access to new markets.

FY 2007 and FY 2008 Targets: FY 2007 and FY 2008 targets are based on appropriations of $46.3M for each year. The decrease in targets between FY 2007 and FY 2008 reflects the impact from a recompetition of the MEP centers and is consistent with executing the Next Generation MEP strategy.

Measure 2b. Increased sales attributed to Hollings MEP Centers receiving Federal funding
Measure 2c. Capital investment attributed to Hollings MEP Centers receiving Federal funding
Measure 2d. Cost savings attributed to Hollings MEP Centers receiving Federal funding

Together the measures above – increased sales, capital investments, and cost savings, all attributed to Hollings MEP Centers receiving Federal funding – provide quantitative indicators of the bottom-line impacts Hollings MEP services provide. As a set, these measures indicate changes that are positively associated with productivity growth and competitiveness – two factors that are crucial for American manufacturers to manage and succeed in the rapidly changing manufacturing environment. Data are collected through an annual survey of clients receiving services from Hollings MEP Centers.

FY 2007 and FY 2008 Targets: FY 2007 and FY 2008 targets are based on appropriations of $46.3M for each year. The decrease in targets between FY 2007 and FY 2008 reflects the impact from a recompetition of the MEP centers and is consistent with executing the Next Generation MEP strategy.

Program Evaluation:

National Academy of Public Administration (NAPA)

In 2004 NAPA, an independent, nonpartisan organization chartered by Congress to improve government performance, completed the second part of a two-phase review of the Hollings MEP program. The first phase focused on re-examining Hollings MEP's core premise, and NAPA found: "…barriers to improving the productivity of small manufacturers identified by earlier studies remain, although they have changed in their relative impacts.... The Panel finds that the core premise of the Program remains viable as it is fulfilling its mission by leveraging both public and private resources to assist the Nation's small manufacturers." The second phase evaluated alternative business models for the program. NAPA provided several recommendations, including:

- Emphasize technology diffusion, product development, and supply chain integration services.
- Build an integrated national network.

- Improve the national coordination of state level organization partnering.
- Review and adopt business best practices used by other federal/state programs.
- Improve the system-wide sharing of knowledge and information and the systems for measuring performance.
- Coordinate with other DOC manufacturing related programs.
- Include structural and operational changes in the strategic planning processes.

Full text versions of the reports are available at http://www.napawash.org/Pubs/NIST0903.pdf and http://www.napawash.org/Pubs/NIST6-2-04.pdf.

Hollings MEP National Advisory Board
External review of the programmatic objectives of MEP is conducted by MEP's National Advisory Board (NAB), which was established by the Secretary of Commerce in October 1996. Recently, the charter for the MEP NAB was amended to add flexibility and respond to the program's shift in emphasis to enhancing firms' innovation capabilities. NIST is now in the process of appointing additional board members and the program has tentatively scheduled the first meeting of the reconstituted board in spring 2007.

Cross-cutting Activities:
Intra-Department of Commerce
Hollings MEP has collaborated with the International Trade Administration (ITA), the Minority Business Development Agency (MBDA), and the Economic Development Administration (EDA) on a number of projects. For example, Hollings MEP has worked with ITA on efforts to open global markets to American small and medium-sized manufacturers interested in but inexperienced with exporting activities.

Other government agencies
Hollings MEP collaborates with a wide range of agencies that regulate or provide programs and services that affect small manufacturing businesses, including the Departments of Agriculture, Defense, Energy, Health and Human Services, Housing and Urban Development, and Labor, as well as with the Environmental Protection Agency, National Aeronautics and Space Administration, and the Small Business Administration.

Government/Private sector
Hollings MEP Centers work directly with small and medium-sized manufacturing establishments, typically those with fewer than 500 employees. Because the centers are joined in a network through NIST, even the smallest firms are able to tap into the expertise of knowledgeable manufacturing and business specialists throughout the United States. The Hollings MEP network of centers positions small manufacturers to compete in the global economy through services that are grounded in business strategy development, advanced marketing techniques, new product development, the integration of supply chains, and increasing the technical and problem solving skills of the workforce. In addition, Hollings MEP leverages public and private resources to help smaller manufacturers by collaborating with a number of organizations, including the National Association of Manufacturers, the State Science and Technology Institute, state and local employment training entities, and hundreds of universities and community colleges.

External Factors and Mitigating Strategies:
The economic and technological environment for small manufacturers in the United States continues to change rapidly. To maximize its effectiveness, Hollings MEP must not only respond rapidly to its clients' changing needs, but also must anticipate changes in the business environment facing smaller manufacturers.

NTIS Performance Goal 1: Increase public access to worldwide scientific and technical information through improved acquisition and dissemination activities.

Corresponding DOC Strategic Goal:

Strategic Goal 2: Promote U.S. innovation and industrial competitiveness by protecting intellectual property, enhancing technical standards, and advancing measurement science.

General Goal/Objective 2.1: Develop tools and capabilities that improve the productivity, quality, dissemination, and efficiency of research

Rationale for Performance Goal:

The National Technical Information Service (NTIS) operates a central clearinghouse of scientific and technical information that is useful to U.S. business and industry. Without appropriated funds, NTIS collects scientific and technical information; catalogs, abstracts, indexes, and permanently archives the information; disseminates products in the forms and formats most useful to its customers; develops electronic and other new media to disseminate information; and provides information processing services to other Federal agencies. NTIS's revenue comes from (1) the sale of technical reports to business and industry, schools and universities, state and local government offices, and the public at large; and (2) services to Federal agencies that help them communicate more effectively with their employees and constituents.

NTIS promotes the development and application of science and technology by providing technologically advanced global e-commerce channels for dissemination of its specialized information to business, industry, government, and the public. The NTIS bibliographic database (from 1990 to the present) is available via the Internet free of charge. Users are allowed to download items in the collection in electronic format for a single low fee or at no charge if under five pages.

Explanation of Performance Measures:

Measure 1a: Number of Updated Items Available (annual)

The number of items available for sale to the public from NTIS includes scientific, technical, and engineering information products added to the permanent collection, as well as items made available through online electronic subscriptions.

Each publication added to the permanent collection is abstracted, catalogued, and indexed so that it can be identified and merged into the permanent bibliographic database for future generations of researchers and the public who may benefit from this valuable research. Other information products are available as full text documents in electronic format through numerous NTIS online information services. This material is acquired primarily from U.S. government agencies, their contractors and grantees, and also from international sources. NTIS collects approximately 35,000 scientific and technical reports annually and another 640,000 items in the form of articles, updates, advisories, etc. that are contained in various subscription products and databases it distributes. The number of updated information products available each year from NTIS is approximately 675,000, but the number largely depends on input from other government agencies.

Measure 1b. Number of Information Products Disseminated (annual)

This measure represents information disseminated and includes compact discs, diskettes, tapes, online subscriptions, Web site pages, as well as traditional paper and microfiche products.

The shift in information dissemination practices from traditional paper copy to electronic-based dissemination has improved NTIS's ability to provide quality products, increase the number of products distributed, and increase the number of customers that have access to valuable scientific and technical information. NTIS is continually striving to stay abreast of the latest technological advances in information dissemination processes to improve its ability to meet the demands of the public. NTIS continues to enhance its ability to stay current in the e-commerce environment, while continuing to serve customers that require the more traditional distribution methods, as demonstrated in our targets above.

FY 2007 and FY 2008 Targets: The FY 2007 and FY 2008 targets have been increased to reflect increases in expected dissemination activity, as demonstrated in the FY 2005 actual data.

Measure 1c. Customer Satisfaction

This measure represents the percentage of NTIS customers that are satisfied with the quality of their order, the ease of order placement, and the timely processing of that order. Orders for NTIS's vast collection of scientific and technical information are received by phone, fax, mail, and online, and are filled in a variety of formats. NTIS's continual efforts to maintain and possibly improve this very high rate of customer satisfaction are essential to the success of NTIS's performance and mission to collect and disseminate scientific and business-related information.

The percentage of satisfied customers is derived from the number of customer complaints compared to the total number of orders taken. It does not take into account inquiries about the status of an order or other general questions.

Program Evaluation:

The Office of the Inspector General (OIG) contracted with KPMG and prepared its audit (Audit Report No. FSD-18004-7-0002/November 9, 2006) of NTIS' FY 2006 Financial Statements that includes a review of the Annual Report detailing NTIS' program activity. The audit results indicated that NTIS has established an internal control structure that facilitates the preparation of reliable financial and performance information.

Cross-cutting Activities:

Other government agencies

NTIS provides a variety of services that assist other agencies in developing, producing, and disseminating their information. These services include fax management services; reproduction of paper, computer, and microfiche products; billing and collection services; product storage and distribution; Web hosting; and database management and distribution. Specific examples are listed below:

- Department of Agriculture (Team Nutrition) - NTIS provides USDA with bulk order processing and distribution of its nutrition education materials to its constituents.
- Department of Treasury (U.S. Customs) - NTIS hosts a Web site on behalf of U. S. Customs Service allowing the dissemination of information on legal rulings.

- Office of Personnel Management (OPM) – Recommends NTIS to other government agencies for e-learning support.

External Factors and Mitigating Strategies:

NTIS's requirement to operate on a substantially self-sustaining basis precludes it from making all information in its collection available on the Web for free. Occasionally NTIS receives questions from the public on this issue. NTIS responds with an explanation of the many services (bibliographic control, preservation and storage) included in its pricing.

Data Validation and Verification

NIST

NIST's Program Office conducts an annual review of its quantitative performance data to ensure that it is complete and accurate. During this process, Program Office staff discuss the data with appropriate offices to assess results relative to forecasts and to understand long-term trends and drivers of performance. Program Office staff also review the verification and validation procedures used by the offices that provide the source data and verify that the source data itself is identical to or consistent with the reported data. For its qualitative performance measure, the NIST Program Office provides summary findings from the NRC review of the NIST Laboratories; the complete results of that evaluation are available for public review.

The table below summarizes the data validation and verification processes for each organization in the Technology Administration.

Performance Measure	Data Source	Frequency	Data Storage	Internal Control Procedures	Data Limitations	Actions to be Taken
NIST Measure 1a: Qualitative assessment and review of technical quality and merit using peer review	On-site interviews and discussions with NIST management and research staff by independent external scientific and technical experts, managed by the NRC.	Each Laboratory reviewed every other year.	NRC	Oversight of laboratory-specific expert review panels provided by the NRC.	Data are qualitative in nature	None
NIST Measure 1b: Citation impact of NIST-authored publications	Thomson Scientific, formerly the Institute for Scientific Information (ISI)	Ongoing	NIST	Data represents NIST's "relative citation impact" - that is, the average citation rate per NIST publication relative to Thomson's Scientific's baseline citation rate number for all scientific and technical organizations. Internal controls include verification and review by NIST Information Services Division and the NIST Program Office.	Factors such as self-citations, citation circles, multiple authorship may affect the reliability of any data of this nature. However, even with such factors citation frequency analyses is broadly recognized as an indicator of the importance or utility of a publication.	None
NIST Measure 1c: Peer-reviewed technical publications	*Web of Science*® bibliographic database compiled by Thomson Scientific, formerly the Institute for Scientific Information (ISI).	Ongoing	NIST	Publication data is collected by Thomson Scientific. Data represents analysis performed by NIST Information Services Division. Internal controls include verification and review by the NIST Program Office.	Output only	None

Performance Measure	Data Source	Frequency	Data Storage	Internal Control Procedures	Data Limitations	Actions to be Taken
NIST Measure 1d: Standard Reference Materials (SRMs) sold NIST Measure 1e: NIST-maintained datasets downloaded NIST Measure 1f: Number of calibration tests performed	NIST Technology Services	Ongoing	NIST Technology Services	Data represent direct and verifiable counts of: 1) the number of SRMs sold to customers 2) the number of times a NIST-maintained dataset has been downloaded; and 3) calibration tests performed by the NIST Laboratories. Internal controls include verification and review by NIST Technology Services and the NIST Program Office and Budget Division.	Data provide information on output levels only. NIST measure 2b reflects the number of users accessing these datasets; it does not reflect unique users or capture how the data was used.	None
NIST Measure 2a: Number of clients served by Hollings MEP Centers receiving Federal funding NIST Measure 2b: Increased sales attributed to Hollings MEP Centers receiving Federal funding NIST Measure 2c: Capital investment attributed to Hollings MEP Centers receiving Federal funding NIST Measure 2d: Cost savings attributed to Hollings MEP Centers receiving Federal funding	The client impact survey is administered by a private firm, Synovate, located in Arlington Heights, IL.	The survey is conducted four times per year, and clients are selected based on when they completed the first project with a Hollings MEP Center in the previous year. For example, a client that completes a project with a Hollings MEP Center in February 2004 is surveyed in January/February 2005. This process is used to reduce respondent burden, raise overall response rates, and improve data quality. Clients are asked to estimate how the group of Hollings MEP-provided services over the previous two years has affected their business performance in the 12-month period prior to the survey date.	Survey data is sent directly to Hollings MEP for analysis. Hollings MEP reviews and stores survey data received from Synovate.	Internal controls include verification and significant review of the Synovate data by Hollings MEP staff. Criteria are in place for identifying outliers in the data. Centers verify the outlier and if necessary, the data are revised based on the Center review.	As with similar survey instruments, sources of uncertainty include variation in interpretation of specific questions; variation in the estimation techniques used in response to specific questions; variation in the quality of industry data; missing values; and other common survey problems. Synovate uses standard survey techniques to clean the data, ensure accuracy and reliability, and improve the response rate. Reported data reflect the impact of Hollings MEP services primarily on small manufacturing establishments; on some occasions, Centers may elect to serve establishments with over 500 employees.	None

Performance Measure	Data Source	Frequency	Data Storage	Internal Control Procedures	Data Limitations	Actions to be Taken
NTIS Measure 1a: Number of Updated Items Available (Annual)	NTIS operates and maintains internal systems for collecting acquisition statistics.	Data is available daily. Reports are produced monthly.	All data is stored within NTIS systems.	NTIS' accounting and budget offices analyze and report performance data to management. Data verification is provided through regular internal independent auditor reporting.	Output Only	None
NTIS Measure 1b: Number of Information Products Disseminated (Annual)	NTIS records every transaction using a commercial order processing system modified to meet its specific needs together with a standard Web analysis software package used by industry.	Internal management activity reports are produced daily, summaries are produced monthly.	All data is stored within NTIS systems.	NTIS' accounting and budget offices analyze and report performance data to management. Data verification is provided through regular internal independent auditor reporting.	Output Only	None
NTIS Measure 1c: Customer Satisfaction	NTIS operates and maintains internal systems for processing collected information. NTIS records every transaction using a commercial order processing system modified to meet its specific needs.	Internal management activity reports are produced daily, summaries are produced monthly.	All information is stored within NTIS systems.	NTIS accounting and budget offices analyze and report performance data to management. Data verification is provided through regular internal and independent auditor reporting.	None	None

Department of Commerce
Technology Administration
Office of the Under Secretary for Technology
Salaries and Expenses
SUMMARY OF RESOURCE REQUIREMENTS
(Dollar amounts in thousands)

	Positions	FTE	Budget Authority	Direct Obligations
2007 Continuing Resolution	5	7	$2,000	$2,000
Adjustment to support level in FY 2007 President's Budget	...	(2)	(515)	(515)
2008 Adjustments to base:				
plus: Uncontrollable cost changes	0	0	89	89
less: Amount absorbed	0	0	(81)	(81)
2008 Base Request	5	5	1,493	1,493
plus: 2008 Program change	(5)	(3)	64	64
less: Unobligated balance end of year	0	0	0	(176)
2008 Estimate	0	2	1,557	1,381

		2006 Actual		2007 Continuing Resolution		2008 Base		2008 Estimate		Increase/ (Decrease) Over 2008 Base	
Comparison by activity/subactivity:		Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount
Under Secretary for Technology											
Under Secretary for Technology	Pos./BA	10	$5,923	5	$2,000	5	$1,493	0	$1,557	(5)	$64
	FTE/Obl.	14	5,495	7	2,000	5	1,493	2	1,381	(3)	(112)
TOTALS	Pos./BA	10	5,923	5	2,000	5	1,493	0	1,557	(5)	64
	FTE/Obl.	14	5,495	7	2,000	5	1,493	2	1,381	(3)	(112)
Adjustments for:											
Recoveries			0		0		0		0		0
Unobligated balance, start of year			0		0		0		0		0
Unobligated balance, end of year			0		0		0		176		176
Unobligated balance expiring			428		0		0		0		0
Budget Authority			5,923		2,000		1,493		1,557		64
Financing from transfers:											
Transfers to other accounts (+)			0		0		0		0		0
Appropriation			5,923		2,000		1,493		1,557		64

Department of Commerce
Technology Administration
Office of the Under Secretary for Technology
Salaries and Expenses
SUMMARY OF REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Comparison by activity:		2006 Actual		2007 Continuing Resolution		2008 Base		2008 Estimate		Increase/ (Decrease) Over 2008 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount
Under Secretary for Technology											
Under Secretary for Technology	Pos./BA	0	$250	0	0	0	0	0	0	0	0
	FTE/Obl.	0	236	0	0	0	0	0	0	0	0

Department of Commerce
Technology Administration
Office of the Under Secretary for Technology
Salaries and Expenses
SUMMARY OF FINANCING
(Dollar amounts in thousands)

	2006 Actual	2007 Continuing Resolution	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
Total Obligations	$5,731	$2,000	$1,493	$1,381	($112)
Financing:					
Offsetting collections from:					
Federal funds	(236)	0	0	0	0
Non-Federal sources	0	0	0	0	0
Total offsetting collections	(236)	0	0	0	0
Unobligated balance, start of year	0	0	0	0	0
Unobligated balance, end of year	0	0	0	176	176
Unobligated balance expiring	428	0	0	0	0
Budget Authority	5,923	2,000	1,493	1,557	64
Financing:					
Transfer to other accounts	0	0	0	0	0
Transfer from other accounts	0	0	0	0	0
Appropriation	5,923	2,000	1,493	1,557	64

Department of Commerce
Technology Administration
Office of the Under Secretary for Technology
Salaries and Expenses
ADJUSTMENTS TO BASE
(Dollar amounts in thousands)

	Perm. Pos.	FTE	Amount
Other Changes:			
Annualization of 2007 Pay raise	...	...	$20
2008 Pay increase and related costs	...	...	22
Change in compensable days	...	...	5
Personnel benefits:			
Civil Service Retirement System (CSRS)	...	...	3
Federal Employees' Retirement System (FERS)	...	...	(4)
Thrift Savings Plan (TSP)	...	...	(1)
Federal Insurance Contribution Act (FICA) - OASDI	...	...	(3)
Health insurance	...	...	4
Rental payments to GSA	...	...	2
Other services:			
Working Capital Fund (Departmental Management)	...	...	35
General pricing level adjustment:			
Other services	...	...	6
Total, Adjustments to base required	0	0	89
Amount absorbed	0	0	(81)
Total, Adjustments to base requested	0	0	8

Department of Commerce
Technology Administration
Office of the Under Secretary for Technology
Salaries and Expenses
JUSTIFICATION OF ADJUSTMENTS TO BASE
(Dollar amounts in thousands)

	FTE	Amount
Other Changes:		
Annualization of 2007 pay raise	0	$20

A pay raise of 2.2 percent is assumed to be effective January 1, 2007.

Total cost in FY 2008 of 2007 pay raise	$78,667
Less amount requested in FY 2007	(59,000)
Less amount absorbed in FY 2007	0
Amount requested in 2008 to provide full-year cost of 2007 pay raise	19,667
Payment to Departmental Management Working Capital Fund	0
Total FY 2007 pay raise increase in FY 2008	19,667

2008 Pay increase and related costs	0	22

A general pay raise of 3.0 percent is assumed to be effective January 1, 2008.

Total cost in FY 2008 of pay increase	$14,000
Amount absorbed in FY 2008	0
Amount requested for FY 2008 pay raise	14,000
Payment to Departmental Management Working Capital Fund	8,000
Total adjustment for FY 2008 pay increase	22,000

Change in compensable days 0 5

The increased cost of two more compensable days in FY 2008 compared to FY 2007 is calculated by dividing the FY 2007 estimated personnel compensation ($519,000) and applicable benefits ($131,000) by 260 compensable days. The cost increase of two more compensable days is $5,000.

Personnel benefits 0 (1)

Civil Service Retirement System (CSRS)	$3
Federal Employees' Retirement System (FERS)	(4)
Thrift Savings Plan (TSP)	(1)
Federal Insurance Contribution Act (FICA) - OASDI	(3)
Health Insurance	4

Civil Service Retirement System ($3,000) – The number of employees covered by the Civil Service Retirement System (CSRS) has risen when compared with FERS employees. The estimated percentage of payroll for employees covered by CSRS will increase from 14.1 percent in FY 2007 to 21.8 percent in FY 2008. The contribution rate will remain at 7.0 percent in FY 2008.

Payroll subject to retirement systems ($519,000)	
Cost of CSRS contributions in FY 2008 ($519,000 x .218 x .07)	$7,920
Cost of CSRS contributions in FY 2007 ($519,000 x .141 x .07)	5,123
Total adjustment to base	2,797

Federal Employees' Retirement System (-$4,000) – The number of employees covered by FERS has decreased when compared with CSRS employees. The estimated percentage of payroll for employees covered by FERS will decrease from 85.9 percent in FY 2007 to 78.2 percent in FY 2008. The contribution rate will remain at 11.2 percent in FY 2008.

Payroll subject to retirement systems ($519,000)	
Basic benefit cost in FY 2008 ($519,000 x .782 x .112)	$45,456
Basic benefit cost in FY 2007 ($519,000 x .859 x .112)	49,932
Total adjustment to base	(4,476)

Thrift Savings Plan (-$1,000) – The cost of agency contributions to the Thrift Savings Plan will decrease as the number of FERS employees decreases. The contribution rate will remain at 2.0 percent in FY 2008.

Thrift plan cost in FY 2008 ($519,000 x .782 x .02)	$8,117
Thrift plan cost in FY 2007 ($519,000 x .859 x .02)	8,916
Total adjustment to base	(799)

Federal Insurance Contributions Act (FICA) - OASDI (-$3,000) – As the percentage of payroll covered by CSRS increases in FY 2008, the cost of OASDI contributions will decrease. In addition, the maximum salary subject to OASDI tax will increase from $96,150 in FY 2007 to $102,300 in FY 2008. The OASDI tax rate will remain 6.2 percent in FY 2008.

FERS payroll subject to FICA tax in 2008 ($519,000 x .782 x .801 x .062)	$20,156
FERS payroll subject to FICA tax in 2007 ($519,000 x .859 x .821 x .062)	22,693
Decrease (FY 2007-FY 2008)	(2,537)
OTP payroll subject to FICA tax in 2008 ($8,000 x .782 x .801 x .062)	311
OTP payroll subject to FICA tax in 2007 ($8,000 x .859 x .821 x .062)	350
Decrease (FY 2007-FY 2008)	(39)
Total adjustment to base	(2,576)

Health insurance ($4,000) – Effective January 2006, TA's contribution to Federal employees' health insurance premiums increased by 9.3 percent. Applied against the FY 2007 estimate of $39,000, the additional amount required is $3,627.

Rental payments to GSA	0	2

GSA rates are projected to increase 2.4 percent in FY 2008

Other services	0	35

An additional amount of $35,000 is required to fund cost increases in the Departmental Management Working Capital Fund.

General pricing level adjustment	0	6

This request applies the OMB economic assumptions of 1.8 percent for FY 2008 where the prices that the government pays are established through the market system. This factor was applied to other services for an increase of $5,598.

Total adjustments to base required	0	89
Less amount absorbed[1]	0	(81)
Total, adjustments to base requested	0	8

[1] *TA will absorb $81,000 of adjustments to base in all applicable object classes.*

Department of Commerce
Technology Administration
Office of the Under Secretary for Technology
Salaries and Expenses
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Under Secretary for Technology
Subactivity: Under Secretary for Technology

Line Item		2006 Actual		2007 Continuing Resolution		2008 Base		2008 Estimate		Increase/ (Decrease) Over 2008 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount
Under Secretary for Technology	Pos./BA	10	$5,923	5	$2,000	5	$1,493	0	$1,557	(5)	$64
	FTE/Obl.	14	5,495	7	2,000	5	1,493	2	1,381	(3)	(112)

Department of Commerce
Technology Administration
Office of the Under Secretary for Technology
Salaries and Expenses
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Under Secretary for Technology
Subactivity: Under Secretary for Technology

Line Item		2006 Actual		2007 Continuing Resolution		2008 Base		2008 Estimate		Increase/ (Decrease) Over 2008 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount
Under Secretary for Technology	Pos./BA	0	$250	0	0	0	0	0	0	0	0
	FTE/Obl.	0	236	0	0	0	0	0	0	0	0

Department of Commerce
Technology Administration
Salaries and Expenses
JUSTIFICATION OF PROGRAM AND PERFORMANCE
OFFICE OF THE UNDER SECRETARY FOR TECHNOLOGY
Congressional Submission

Goal Statement

The Technology Administration (TA) works to improve U.S. technological competitiveness and promote U.S. innovation policy in the Executive Branch, before Congress, and in international fora. The Under Secretary for Technology serves as one of the principal officials responsible for the Administration's technology policy, developing and promoting national policies and initiatives that use technology and foster innovation to build America's economic strength. The statutory role of the Under Secretary is to serve in a leadership capacity for the National Institute of Standards and Technology (NIST) and the National Technical Information Service (NTIS). The Under Secretary also has delegated authorities from the Secretary, and currently serves as the Department's Chief Privacy Officer. Beginning in FY 2008, TA's Office of the Under Secretary is proposed to be eliminated and its policy activities will be elevated to the Secretary's office.

Base Program

TA's base resources will provide for the orderly shutdown of the Office of the Under Secretary, as technology policy activities are elevated to the Secretarial level. Base funding will be used for personnel and other costs associated with this effort.

Department of Commerce
Technology Administration
Office of the Under Secretary for Technology
Salaries and Expenses
INCREASE FOR FY 2008
(Dollar amounts in thousands)

		2008 Base		2008 Estimate		Increase/(Decrease) Over 2008 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Under Secretary for Technology.....	Pos./BA	5	$1,493	0	$1,557	(5)	$64
	FTE/Obl.	5	1,493	2	1,381	(3)	(112)

Under Secretary for Technology (-5 Permanent Positions, -3 FTE, Budget Authority +$64,000, Obligations -$112,000) – Technological innovation has evolved to a point where it plays a critical role in competitiveness across our entire economy rather than taking place in an isolated sector unto itself. In keeping with this evolution, the FY 2008 Budget proposes to modernize the Department's approach to technology policy by elevating technology policy activities to the Secretarial level. In place of a stand-alone Technology Administration, the Budget proposes to appoint a senior advisor in the Department's Office of Policy and Strategic Planning and to create a Department-wide Technology Council that will coordinate technology policy activities that are distributed across the Department. Under this proposal, NIST would report directly to the Department, and NTIS would report to the Department through NIST. Requested resources will permit an orderly shutdown and include $176,000 for anticipated severance payments which will continue into FY 2009. Two-year authority is requested to accommodate the severance payments.

Department of Commerce
Technology Administration
Office of the Under Secretary for Technology
Salaries and Expenses
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Under Secretary for Technology
Subactivity: Under Secretary for Technology
Program Change: Under Secretary for Technology

Title	Number	Total Salaries
Professional and administrative personnel (positions)	(5)	($664,641)
		0
Subtotal	(5)	(664,641)
Less lapse	2	332,321
Total full-time permanent (FTE)	(3)	(332,320)
Lump sum annual leave		93,600
Total		(238,720)

Personnel Data	
Full-Time Equivalent Employment:	
Full-time permanent	(3)
Authorized Positions:	
Full-time permanent	(5)

Exhibit 15

Department of Commerce
Technology Administration
Office of the Under Secretary for Technology
Salaries and Expenses
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Under Secretary for Technology
Subactivity: Under Secretary for Technology
Program Change: Under Secretary for Technology

Object Class		2008 Increase/ (Decrease) Obligations
11	Personnel compensation	
11.1	Full-time permanent	($239)
11.9	Total personnel compensation	(239)
12.1	Civilian personnel benefits	(64)
13	Benefits for former personnel	247
21	Travel and transportation of persons	(2)
22	Transportation of things	0
23.1	GSA rental	(74)
23.3	Communications, utilities and miscellaneous charges	(6)
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	38
25.3	Purchases of goods and services from Government accounts	0
25.7	Operation and maintenance of equipment	(4)
26	Supplies and materials	(8)
31	Equipment	0
32	Land and structures	0
41	Grants, subsidies and contributions	0
99	Direct obligations	(112)
	FY 2008 Unobligated balance	176
	Total requirements	64

Department of Commerce
Technology Administration
Office of the Under Secretary for Technology
Salaries and Expenses
SUMMARY OF REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

	Object Class	2006 Actual	2007 Continuing Resolution	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
11	Personnel compensation					
11.1	Full-time permanent	$1,742	$896	$665	$426	($239)
11.3	Other than full-time permanent	0	0	0	0	0
11.5	Other personnel compensation	67	0	0	0	0
11.9	Total personnel compensation	1,809	896	665	426	(239)
12.1	Civilian personnel benefits	406	188	137	73	(64)
13	Benefits for former personnel	100	0	0	247	247
21	Travel and transportation of persons	113	4	4	2	(2)
22	Transportation of things	5	3	3	3	0
23.1	Rental payments to GSA	354	219	221	147	(74)
23.2	Rental payments to others	0	0	0	0	0
23.3	Communications, utilities, and miscellaneous charges	25	15	15	9	(6)
24	Printing and reproduction	12	2	2	2	0
25.1	Advisory and assistance services	0	0	0	0	0
25.2	Other services	1,063	145	35	73	38
25.3	Purchases of goods and services from government accounts	1,566	508	391	391	0
25.7	Operation and maintenance of equipment	11	9	9	5	(4)
26	Supplies and materials	22	10	10	2	(8)
31	Equipment	9	1	1	1	0
41	Grants, subsidies, and contributions	0	0	0	0	0
42	Insurance claims and indemnities	0	0	0	0	0
43	Interest and Dividends	0	0	0	0	0
99	Total Obligations	5,495	2,000	1,493	1,381	(112)

	Object Class	2006 Actual	2007 Continuing Resolution	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
99	Total Obligations	5,495	2,000	1,493	1,381	(112)
	Less Prior Year Recoveries	0	0	0	0	0
	Less Prior Year Unobligated Balance	0	0	0	0	0
	Plus Unobligated Balance, End of Year	0	0	0	176	176
	Plus Unobligated Balance Expiring	428	0	0	0	0
	Total Budget Authority	5,923	2,000	1,493	1,557	64

Personnel Data

Full-time equivalent employment:					
Full-time permanent	13	7	5	2	(3)
Other than full-time permanent	1	0	0	0	0
Total	14	7	5	2	(3)
Authorized Positions:					
Full-time permanent	9	5	5	0	(5)
Other than full-time permanent	1	0	0	0	0
Total	10	5	5	0	(5)

Exhibit 17

Department of Commerce
Technology Administration
Office of the Under Secretary for Technology
Salaries and Expenses
DETAILED REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

	Object Class	2008 Adjustments to Base	2008 Base	2008 Estimate	Increase/ (Decrease) over 2008 Base
11	Personnel compensation				
11.1	Full-time permanent				
	Executive level	0	$159	$102	($57)
	Senior executive service	0	0	0	0
	Career path	$8	506	324	(182)
	Subtotal	8	665	426	(239)
11.3	Other than full-time permanent				
	Senior executive service	0	0	0	0
	Career path	0	0	0	0
	Experts & consultants	0	0	0	0
	Subtotal	0	0	0	0
11.5	Other personnel compensation				
	Overtime	0	0	0	0
	SES performance awards	0	0	0	0
	Cash awards	0	0	0	0
	Other	0	0	0	0
	Subtotal	0	0	0	0
11.9	Total personnel compensation	8	665	426	(239)

	Object Class	2008 Adjustments to Base	2008 Base	2008 Estimate	Increase/ (Decrease) over 2008 Base
12.1	Civilian personnel benefits				
	Civil service retirement	0	10	5	(5)
	Federal employees' retirement	0	47	25	(22)
	Thrift savings plan	0	19	10	(9)
	Federal Insurance Contribution Act	0	32	17	(15)
	Health insurance	0	28	15	(13)
	Life insurance	0	1	1	0
	Employees' Compensation Fund	0	0	0	0
	Other	0	0	0	0
	Subtotal	0	137	73	(64)
13	Benefits for former personnel				
	Severance pay	0	0	247	247
	Unemployment compensation	0	0	0	0
	Other	0	0	0	0
	Subtotal	0	0	247	247
21	Travel and transportation of persons				
	Common carrier	0	3	2	(1)
	Mileage	0	1	0	(1)
	Per diem/actual	0	0	0	0
	Other	0	0	0	0
	Subtotal	0	4	2	(2)
22	Transportation of things	0	3	3	0
23.1	Rental payments to GSA	0	221	147	(74)
23.2	Rental payments to others	0	0	0	0

	Object Class	2008 Adjustments to Base	2008 Base	2008 Estimate	Increase/ (Decrease) over 2008 Base
23.3	Communications, utilities, and misc. charges				
	Rental of ADP equipment	0	0	0	0
	Rental of office copying equipment	0	0	0	0
	Other equipment rental	0	0	0	0
	Federal telecommunications system	0	0	0	0
	Other telecommunications services	0	12	6	(6)
	Postal Service by USPS	0	3	3	0
	Other	0	0	0	0
	Subtotal	0	15	9	(6)
24	Printing and reproduction				
	Publications	0	0	0	0
	Other	0	2	2	0
	Subtotal	0	2	2	0
25.1	Advisory and asssistance services				
	Management & professional support services	0	0	0	0
	Studies, analyses, and evaluation	0	0	0	0
	Engineering technical services	0	0	0	0
	Subtotal	0	0	0	0
25.2	Other services				
	Training	0	5	5	0
	ADP Services	0	4	2	(2)
	Other non-government contracts	0	26	66	40
	Subtotal	0	35	73	38

	Object Class	2008 Adjustments to Base	2008 Base	2008 Estimate	Increase/ (Decrease) over 2008 Base
25.3	Purchases of goods and services from Government accounts				
	Payments to DM, WCF	0	351	351	0
	Office of Personnel Management	0	0	0	0
	Other Federal agencies	0	40	40	0
	Subtotal	0	391	391	0
25.7	Operation and maintenance of equipment	0	9	5	(4)
26	Supplies and materials				
	Office supplies	0	4	2	(2)
	Other	0	6	0	(6)
	Subtotal	0	10	2	(8)
31	Equipment				
	Office machines and other equipment	0	1	1	0
	ADP equipment	0	0	0	0
	Subtotal	0	1	1	0
41	Grants, subsidies, and contributions	0	0	0	0
42	Insurance claims and indemnities	0	0	0	0
99	Total Obligations	8	1,493	1,381	(112)

Department of Commerce
Technology Administration
Office of the Under Secretary for Technology
Salaries and Expenses
SUMMARY OF INFORMATION TECHNOLOGY RESOURCES
(Dollar amounts in thousands)
(Budget Authority)

IT Projects by Activity/Subactivity: (Totals by Activity)	Unique Project Identifier	IT Investment Title	2006 Actual	2007 Estimate	2008 Estimate	Increase/ Decrease
Under Secretary for Technology			0	0	0	0

Department of Commerce
Technology Administration
Office of the Under Secretary for Technology
Salaries and Expenses
APPROPRIATION LANGUAGE AND CODE CITATIONS

For necessary expenses for the Under Secretary for Technology, $1,557,000–to be made available until FY 2009 (2 year funding).

15 U.S.C. 1151 (e)
15 U.S.C. 1533
15 U.S.C. 3704
15 U.S.C. 3711a

15 U.S.C. 1151-1152 provides for the Secretary of Commerce to make available to American industry and business technical information from multiple sources and to coordinate the dissemination of that information.

15 U.S.C. 1533 provides for the establishment of the Commerce Science and Technology Fellowship Program, which is administered by the Office of the Under Secretary, to enhance the career development of promising Federal employees.

15 U.S.C. 3704 establishes the Technology Administration and places within it the National Institute of Standards and Technology, the National Technical Information Service, and the Office of Technology Policy; creates the positions of Under Secretary for Technology and Assistant Secretary for Technology Policy; provides for the management of the Technology Administration by the Under Secretary and the supervision of its agencies, programs and activities; and provides the basic authority for preparing technology policy analyses, experiments, studies, and reports.

15 U.S.C. 3711 provides for the award by the President of the National Medal of Technology based upon recommendations of the Secretary of Commerce.

Additional authorizing legislation will not be proposed for FY 2008.

Department of Commerce
Technology Administration
Office of the Under Secretary for Technology
AVERAGE SALARY

	2006 Actual	2007 Estimate	2008 Estimate
Average Career Path Salary	$122,761	$123,904	0

Exhibit 1

Department of Commerce
Technology Administration
National Institute of Standards and Technology
BUDGET ESTIMATES, FISCAL YEAR 2008
CONGRESSIONAL SUBMISSION

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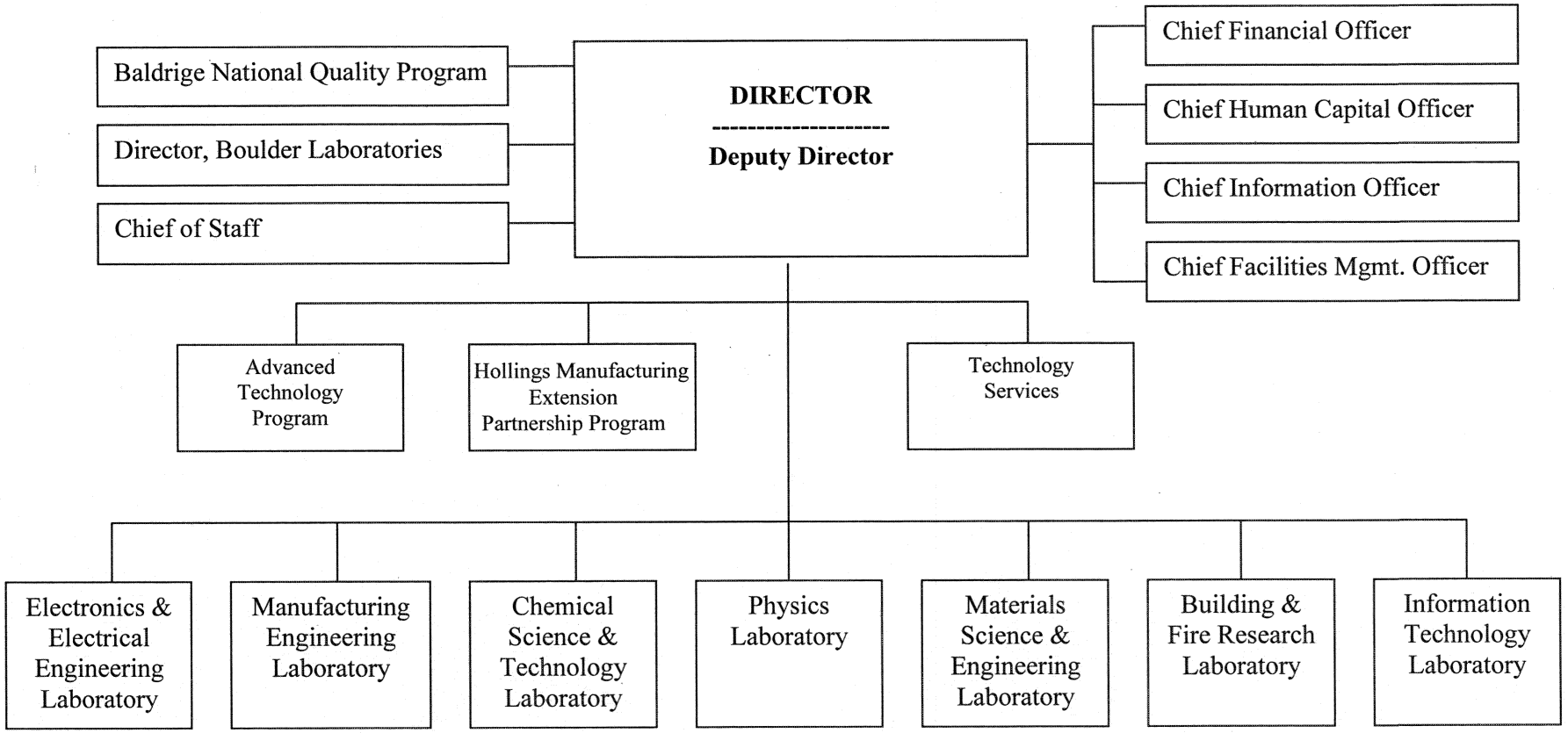
Exhibit 2

U.S. DEPARTMENT OF COMMERCE
National Institute of Standards and Technology



DEPARTMENT OF COMMERCE
TECHNOLOGY ADMINISTRATION
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
Budget Estimates, FY 2008
Congressional Budget Submission

EXECUTIVE SUMMARY

"Tonight I announce an American Competitiveness Initiative, to encourage innovation throughout our economy…I propose to double the federal commitment to the most critical basic research programs in the physical sciences over the next 10 years. This funding will support the work of America's most creative minds as they explore promising areas such as nanotechnology, supercomputing, and alternative energy sources. "

President George W. Bush
State of the Union
January 31, 2006

Since the dawning of our Nation, ingenuity and a capacity for innovation have led to American prosperity. Indeed, economic studies show that technological innovation has accounted for half of our economic growth since the World War II. Keeping our competitive edge in the world economy depends on our Nation's ability to generate and harness the latest in scientific and technological developments–particularly in the physical sciences and engineering–and to apply these developments to real world applications. The Commerce Department's National Institute of Standards and Technology (NIST) has served in this role since the early days of the 20th century by efficiently and effectively working to promote innovation across the broad and ever-changing landscape of science, technology, and the economy.

The NIST mission–to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards and technology in ways that enhance economic security and improve our quality of life–only hints at the daily, real-world impact of NIST's research, development, and other technical activities. NIST's role and importance to the development of measurements in commerce is clear; the Institute's measurement expertise underpins the quality of the water we drink, the air we breathe, and the food we eat. NIST standards ensure that consumers are confident of the quantity and quality of the product purchased, whether it is a gallon

of gasoline or the amount of electricity reflected in a monthly bill. They protect our banking at ATMs and our online purchases. But NIST's impact is felt far beyond that. For example:

- While our Nation has long been a world leader in measuring the performance of lasers, NIST is the world's only national measurement laboratory to offer a comprehensive characterization of the short-wavelength ultraviolet lasers used in state-of-the-art semiconductor manufacturing tools. NIST's work in measuring and establishing standards for these lasers has helped ensure that manufacturing tools from different vendors and suppliers are interchangeable, enabling manufacturing cost efficiencies that result in smaller, faster and more affordable semiconductors and computer chips.
- NIST's expertise in low level sulfur determinations is essential for implementing the Environmental Protection Agency's regulations which mandate an upper limit of 15 parts-per-million of sulfur in diesel fuel. Using newly devised measurement techniques, NIST is developing standard samples of diesel fuel oil with sulfur content measured at low levels that were previously unattainable. These new standards will enable the development of processes for manufacturing ultra low sulfur diesel fuel that will reduce the amount of sulfur released to the environment and make it possible to achieve health and welfare benefits estimated at $150 billion annually.
- NIST standards, proficiency tests and calibrations ensure proper radiation exposure levels in more than 9,000 facilities that perform more than 30 million mammograms yearly and underpin the safety and effectiveness of about 10 million medical procedures that use radioactive materials–from prostate and breast-cancer treatment to diagnostic imaging.
- NIST's leadership in the development and support of reference standards for in vitro diagnostic devices is helping U.S. manufacturers of such products as glucose and cholesterol test kits meet requirements of new European Union regulations–keeping U.S. manufacturers competitive in a $7 billion European market.
- NIST researchers contribute their expertise and resources to hundreds of private-sector standards committees and organizations that put the United States in a better position to innovate, improve marketplace efficiency, and increase global trade competitiveness. In 2006, NIST staff held 1,324 memberships in 972 standards committees, and chaired 161 of them. The NIST-chaired Working Group on Broadband Wireless Access, for example, has over 340 members worldwide. This group is recognized by industry for its essential work in developing the latest standards for broadband wireless metropolitan area networks. The NIST-chaired working group's standard has received numerous awards and continues to attract international support as an alternate means of providing broadband access to homes, businesses, and individual users.
- NIST's technical contributions to the development of encryption standards for information technology are estimated to have saved private industry more than $1 billion—and allowed consumers and businesses to be confident about the security of billions of dollars worth of daily electronic data transactions such as withdrawals from ATMs.

- Roughly 350 different reference materials supplied by NIST support the products of U.S. automakers and their suppliers–an industry that accounts for more than three percent of the Nation's gross domestic product.
- NIST manages the Malcolm Baldrige National Quality Award that recognizes U.S. organizations for performance excellence and quality achievements, and that is estimated to have brought the United States a total economic benefit of almost $25 billion – a benefit-cost ratio of 207 to 1.

Throughout the last decade, political and technical forces have combined to open up much of the globe to commerce. Increased emphasis in the sciences–particularly the physical, life, and information sciences emanating from India and China has spurred an environment where continuous innovation must be sustained to maintain economic success. The opening up of these new markets is creating intense competition as well as opportunity. History demonstrates that innovation requires advancement in the physical sciences. New discoveries in the physical sciences spur innovation in nearly every other field. Technological innovation will ensure continued U.S. leadership in science and engineering, which will in turn drive productivity, grow the economy, and solve important societal problems.

These two trends–globalization and technology innovation–are intensifying. The proposed FY 2008 budget will enable NIST to heighten its emphasis on the development of measurement science and standards that support U.S. interests and the President's highest research and development (R&D) priorities: Nanotechnology, Energy, Environment, and the Physical Sciences. NIST's key role among Federal science and technology agencies is more critical now than ever as America today finds herself at a crossroads when it comes to leading the world in science and innovation.

The Institute's reputation and past accomplishments are known world-wide, and its level of excellence sets the standards for all research institutions. NIST is focused on the most critical and challenging developing technologies and industries of the new century and the measurements and standards that will be crucial if U.S. industry is to excel in the future. Requested increases for the NIST Laboratories match the President's R&D priorities and industry's measurements and standards needs. Discoveries and advances in Nanotechnology have the potential to transform manufacturing and business industries through innovation and productivity improvements. Similarly, discoveries in Quantum Science promise to forever change technology in the 21st century. Breakthroughs in our understanding of the forces in the Environment will establish baselines for monitoring and predicting the global climate and the disaster resilience of our structures and communities. And, the continued expansion of the NIST Center for Neutron Research (NCNR) will allow the Nation's leading neutron facility to aid additional scientists and engineers in differentiating between novel materials that will be used in advanced products and devices. These are the challenges and opportunities that face the Nation and NIST in the 21st century, challenges that the Institute will be better equipped to address as a result of this budget. As in the past, America's innovators in science, industry, and academia can change the world, but like Archimedes and his lever, they need a firm place upon which to stand. NIST provides that infrastructural platform through measurements, standards, and technology expertise.

Strategic Environment: Conditions and Assumptions

NIST is an essential link in the Nation's scientific and technological enterprise, providing the measurements, standards and technologies essential for innovation leading to new products and services, fair and equitable exchange of products in the marketplace, public safety and security, and quality of life. The NIST Laboratories constitute a bedrock of knowledge relied upon by business and industry from the smallest entrepreneurial start-ups to the largest multi-national corporations.

NIST's measurement expertise ranges from daily, commonplace metering of home electric power and supermarket weights and measures to the world's most advanced technologies for atomic clocks, nano-scale measurement and quantum computing. The ability to test, measure, and verify is at the heart of all scientific and technological progress, and these skills are the core NIST mission. For example, NIST researchers were essential to the development of new standards for verifying the performance of equipment for detecting dirty bombs and other radiation hazards; they developed test and measurement methods that are cornerstones of the initial industry standards published for the new fields of micromachines and microelectromechanical systems; and they catalyzed the formation of a multi-agency effort to coordinate and maximize the effectiveness of the Federal government's manufacturing R&D programs. In addition to its work with and for industry, the Institute's primary customer, NIST provides universities and Federal agencies–civilian and military–with research and measurement support, and works with state and local governments, through the National Conference on Weights and Measures, to ensure a fair and consistent measurement system across the Nation. Internationally, NIST promotes traceability of measurements to recognized standards in order to minimize barriers to trade and to promote global scientific collaboration.

In addition to its core measurement and standards functions, NIST manages two extramural programs: the Hollings Manufacturing Extension Partnership (MEP) program, to help smaller firms adopt new manufacturing and management technologies to improve their competitiveness; and the Baldrige National Quality Program, to help U.S. businesses and other organizations improve the performance and quality of their operations by providing clear standards and benchmarks of quality. Strengthening innovation is the goal of each of these programs.

NIST pursues frontier research to remain credible as a national standards laboratory and vital to industry as a source of measurement and standards technical expertise. Its researchers have earned three Nobel prizes, a National Medal of Science, and a MacArthur Foundation grant. In addition, 16 of NIST's staff have been elected to 18 memberships in the National Academies of Science or Engineering, with two members elected to both. NIST's impact is disproportionate to its relatively small size. One measure of the Institute's success includes economic impact studies conducted by independent experts. Nineteen studies conducted over the last ten years–for projects ranging from alternative refrigerants to cholesterol measurements to data encryption standards–demonstrated that, on average, a dollar invested in these NIST research projects returned $44 in direct economic benefit to the Nation.

NIST Goals and Focus of the FY 2008 Budget Request

NIST is a relatively small component of the Nation's scientific R&D enterprise. To maximize its effectiveness, NIST selects major research initiatives that are highly leveraged to provide the greatest possible return to the American taxpayer on the investment of NIST resources. NIST's FY 2008 Scientific and Technical Research and Services (STRS) and Construction of Research Facilities (CRF) appropriations budget request of $594.4 million is an integral component of the President's 10-year American Competitiveness Initiative (ACI). This reflects a 16 percent increase over the FY 2007 recurring program for STRS and CRF. The FY 2008 budget for NIST emphasizes strategic areas in which NIST has unique expertise that are critically important to the Nation's future economic and physical security and are among the Administration's top R&D priorities.

Summary of FY 2008 Proposed Budget Request

To carry out its mission and strategic goals, NIST is requesting for FY 2008 a total budget of $640,714,000, 2,791 permanent positions, and 2,906 FTE. This budget request also includes program changes totaling $69,250,000, 56 permanent positions, and 42 FTE.

The FY 2008 budget request for the Construction of Research Facilities appropriation totals $93,865,000, 51 permanent positions, and 50 FTE and funds the initial phase of construction of the Building 1 Extension ($28,000,000) and completes the construction portion of the NCNR Expansion and Reliability Improvements initiative ($19,000,000).

The FY 2008 budget request for the Scientific and Technical Research and Services appropriation totals $500,517,000, 2,006 permanent positions, and 2,020 FTE, and includes the following major initiative components:

Enabling Nanotechnology from Discovery to Manufacture	$6,000,000	15 permanent positions	11 FTE
Enabling Innovation through Quantum Science	$4,000,000	13 permanent positions	10 FTE
Measurements and Standards for the Climate Change Science Program	$5,000,000	20 permanent positions	15 FTE
Disaster Resilient Structures & Communities	$4,000,000	5 permanent positions	4 FTE
National Earthquake Hazards Reduction Program Initiative	$3,250,000	3 permanent positions	2 FTE

The FY 2008 budget request for the Industrial Technology Services appropriation totals $46,332,000, 48 permanent positions, and 72 FTE.

American Competitiveness Initiative

Technological innovation drives the Nation's economic growth and sustains our competitiveness in world markets. "Innovation will be the single most important factor in determining America's success through the 21st century," according to the Report of the National Innovation Initiative, Council on Competitiveness, December 2004. A 2005 National Academy of Sciences report, *Rising Above The Gathering Storm: Energizing and Employing America for a Brighter Economic Future*, states, "Economic studies conducted even before the information-technology revolution have shown that as much as 85 percent of measured growth in U.S. income per capita is due to technological change." New technologies require a sophisticated set of supporting tools to succeed. These tools include knowledgeable people with easy access to key information, measurement science, and production technologies. NIST plays a fundamental role in ensuring access to this innovation toolset.

NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life. This initiative provides the Nation with essential tools to enable continued innovation and economic vitality.

Construction of Research Facilities

Building 1 Extension (+$28,000,000): NIST will begin construction of a unique, high-performance laboratory space with stringent control of temperature, vibration, humidity, and air cleanliness. This facility will provide the metrology infrastructure essential for scientific progress and technical innovation necessary for economic security and industrial competitiveness in the 21st century. NIST-Boulder provides the technical infrastructure needed to support scientific discovery and technical development of transformational technology in homeland security, telecommunications, nanotechnology, precision timing, hydrogen energy sources, precision electrical standards, biotechnology, applications of lasers, electromagnetic interference testing, quantum computing and quantum communications, and other national needs. The proposal represents the optimal combination of new construction, renovation, and major repair to make these resources available to the American industrial and scientific community at minimum cost to the public.

NIST Center for Neutron Research Expansion and Reliability Improvements (+$19,000,000): As the Nation's leading neutron research facility, the NCNR serves more scientists and engineers than all other U.S. facilities combined. In this facility, neutron scattering techniques are used as innovative tools to "see" the structure and dynamics of materials that are critical to moving nanotechnology from discovery to manufacture. The continued expansion of the NCNR, begun in FY 2007, will include the construction of a new Guide Hall and a supporting facilities building. The Guide Hall is a dedicated facility to house the neutron beam delivery system and neutron scattering instruments that are part of this expanded Center for Neutron Research. The associated facilities will support the expanded staff and user base served by the improved NCNR.

Scientific and Technical Research and Services

Enabling Nanotechnology from Discovery to Manufacture (+$6,000,000): Emergent breakthroughs in nanotechnology promise to spur economic growth and development in the early 21st century by increasing the value of existing products, enabling new products, and fostering the growth of high-tech jobs in the U.S. economy. By 2015, sales of nanotechnology-related products are predicted to exceed $1 trillion, with far-reaching effects in many industries.[1] These predictions will only be realized if our Nation can cost-effectively incorporate innovative nanotechnologies into the advanced manufacturing of products and devices. Moving from fundamental discoveries to valuable and marketable devices and products depends upon a measurement infrastructure that allows industry sectors to accurately and reliably differentiate among innovative solutions at the nanoscale.

NIST will continue to build the Nation's nanoscale measurement infrastructure that will nurture and ensure U.S. leadership in the production and use of nanotechnology. Specifically, NIST will construct additional tools for the characterization of nanostructures through advances in materials science, modeling, simulation, and three dimensional imaging. Furthermore, NIST will partner with industry to provide the necessary measurements and standards to enable the development of ultimate CMOS (complementary metal oxide semiconductor) and thereby continue the rapid increase in the delivered value of semiconductor devices, allowing U.S. semiconductor manufacturers to keep pace in the competitive nanotechnology era.

Enabling Innovation through Quantum Science (+$4,000,000): Quantum-based experiments led to many of the technological advances that defined the last century. Advances in quantum mechanics have enabled everyday devices such as computers, cell phones, and even laser scanners found at the checkout counter of every grocery store. Yet the quantum realm holds more surprises, and more possibilities. The exploitation of quantum behavior for innovative leaps in technology requires overcoming barriers to creating the devices that will constitute future quantum technologies. NIST will enhance its Nobel-prize winning work by pushing the limits of scientific understanding in the quantum realm, and building advanced tools and techniques to measure and manipulate nature's smallest particles.

Measurements and Standards for the Climate Change Science Program (+$5,000,000): For more than a decade, the United States has invested heavily in scientific activities related to climate change. In February 2002, the U.S. Climate Change Science Program (CCSP) was launched as a collaborative interagency program, designed to improve the government-wide management of climate science and climate-related technology development. Among the top priorities in the 10 year strategic plan produced by the CCSP were better methods for understanding the impact of aerosols on global warming and calibrating satellites used for understanding the current state of Earth's atmosphere. NIST will develop the necessary measurement science and standards to improve the accuracy of

[1] *M.C. Roco and W.S. Bainbridge, eds., 2001, "Societal Implications of Nanoscience and Nanotechnology", Springer, pp. 3-4.*

climate change predictions, providing policymakers with accurate information about the advantages and consequences of various policy options.

Disaster Resilient Structures and Communities (+$4,000,000): Despite significant progress in disaster-related science and technology, natural and technological disasters in the United States are responsible for an estimated $52 billion in average annual costs in terms of lives lost, disruption of commerce and financial networks, properties destroyed, and the cost of mobilizing emergency response personnel and equipment. Natural hazards–including extreme winds (hurricanes, tornadoes, windstorms) and storm surge, wildland fires, earthquakes, and tsunamis–are a continuing and significant threat to U.S. communities. Human activities that are accidental, criminal, or terrorist can lead to disastrous community losses as well. A single event such as a major earthquake or hurricane could potentially cause $80 billion to $200 billion in economic losses in the affected areas.

The disaster resilience of our structures and communities today is determined in large measure by the building codes, standards, and practices used when they were built. With few exceptions, these legacy codes, standards, and practices that have evolved over several decades are prescriptive, oversimplified, and inconsistent with respect to risk. NIST will develop the scientific basis necessary to address five of the six Grand Challenges identified in a 2005 National Science and Technology Council report entitled *Grand Challenges for Disaster Reduction.*

National Earthquake Hazards Reduction Program Initiative (+$3,250,000): There are close to $8.6 trillion of structures and 75 million people located in urban areas of moderate to high earthquake risk. National Research Council studies estimate that a single large earthquake in the U.S., like the one that struck Kobe, Japan, in 1995, could cause damage of $100 to $200 billion. This initiative will fund research for advanced mitigation technologies and create guidelines for the rehabilitation of existing structures.

President's Management Agenda: Advancing NIST's Organizational Performance

NIST has a long history of designing its programs in response to customer needs, evaluating its programs through external peer review and other rigorous methods, and continuously improving its organizational structure and work systems to maximize efficiency and effectiveness. Consistent with this history, NIST's management goals and processes support each element of the President's Management Agenda, as described below. In FY 2008, NIST will pursue continued improvements in each of these areas using base resources.

Strategic Management of Human Capital: NIST is a high-performing organization with a flat, mission-focused structure. NIST has only four levels of management and has span-of-control numbers that compare favorably with other R&D organizations. NIST uses a variety of powerful human resource tools including pay banding, pay for performance, and recruitment and retention allowances to

manage its workforce. NIST is committed to continuously improving its workforce management practices to meet mission requirements and changing customer needs. NIST's human capital planning and resource requirements are integrated within the Institute's programmatic planning, and human capital needs specific to each program are detailed within this budget request. In addition, NIST has developed a comprehensive Human Capital Strategic Plan that outlines goals and initiatives for meeting NIST's major human capital challenges.

Competitive Sourcing: NIST has developed a comprehensive competitive sourcing plan that has been provided to Congress. NIST continues to focus on improving organizational efficiencies and has recently streamlined several administrative activities.

Improved Financial Performance: NIST routinely receives unqualified audit opinions, provides accurate and timely financial information, and complies with all financial laws and regulations.

Expanded Electronic Government: NIST uses the Internet to deliver services to its customers. To avoid redundancy in that service delivery, NIST is implementing relevant solutions developed through e-Gov initiatives as they are available, such as grants.gov and e-Learning. NIST has certified and accredited over 90 percent of its production systems, and continues to refine its IT security program to improve its level of security. NIST uses its Enterprise Architecture to guide new investments that increase the efficiency of its IT infrastructure, while providing the flexibility needed for a scientific organization to achieve its mission.

Budget and Performance Integration: NIST integrates planning, performance, and evaluation information into its budget submissions. This integration has improved the comprehensiveness and quality of NIST budget justifications.

R&D Investment Criteria: NIST has exemplary and long-standing practices in place for evaluating the relevance, quality, and performance of its research functions–the central objectives of the R&D investment criteria. NIST uses a combination of external peer review, analysis of outputs, industry and association technical roadmaps, and both retrospective and prospective economic impact studies to evaluate the performance and direction of its research programs. NIST's long-term planning process provides the framework for strategy formation and performance evaluation.

Summary of Performance and Resources

Data on the programmatic performance evaluation and reporting for all NIST base programs are provided in Exhibit 3A of this budget request. Performance measures for program changes included in this budget request can be found in the budget justification narrative of each program change.

OMB recognized during the course of the FY 2005 PART assessment of the NIST Laboratories that "R&D-performing organizations typically cannot provide unit cost measures of efficiency due to the long time frame for research, multivariate inputs, and diverse sets of outputs that derive from R&D activities." NIST has developed and obtained approval for efficiency measures for the MEP program.

Resources: The following is a comparison of NIST's FY 2007 Continuing Resolution with its FY 2008 budget request and related data on employment.

Appropriation	(Dollar amounts in thousands)					
	2007 Continuing Resolution		2008 Estimate		Increase or (Decrease) from 2007 Continuing Resolution	
	FTE	Amount	FTE	Amount	FTE	Amount
Scientific and Technical Research and Services	1,854	$395,056	2,020	$500,517	166	$105,461
Industrial Technology Services	125	92,000	72	46,332	(53)	(45,668)
Construction of Research Facilities	50	67,998	50	93,865	0	25,867
Working Capital Fund	764	0	764	0	0	0
TOTAL	**2,793**	**555,054**	**2,906**	**640,714**	**113**	**85,660**

Reimbursable Program

NIST's reimbursable services consist of technical work performed for other Federal agencies, state and local governments, and the private sector. These services include calibrations and special tests, advisory services, and the sale of Standard Reference Materials. The unique measurements and standards expertise developed with appropriated funding gives NIST the capability to perform these services on a reimbursable basis. NIST accepts other-agency work based on an established set of criteria which include: 1) the need for traceability of measurements to national standards; 2) the need for work which can not or will not be addressed by the private sector; 3) work supported by legislation that authorizes or mandates certain services; 4) work which would result in an unavoidable conflict of interest if carried out by the private sector or regulatory agencies; and 5) requests by the private sector for NIST action or services. NIST's reimbursable program is estimated to be $166,333,000 in FY 2007 and $140,846,000 in FY 2008.

A crosswalk of the FY 2008 STRS initiative requests by budget line item follows:

Crosswalk of FY 2008 STRS Requested Increases to Budget Subactivities/Line Items
(Dollars in thousands)

STRS Initiative Name	NIST Laboratories			Total
	Laboratories and Technical Programs		National Research Facilities	
	Physics	Building and Fire Research	Center for Nanoscale Science and Technology	
American Competitiveness Initiative				
Enabling Nanotechnology from Discovery to Manufacture			6,000	6,000
Enabling Innovation through Quantum Science	4,000			4,000
Measurements and Standards for the Climate Change Program	5,000			5,000
Disaster Resilient Structures and Communities		4,000		4,000
National Earthquake Hazards Reduction Program Initiative		3,250		3,250
Total, STRS FY 2008 Initiatives by Subactivity and Line Item	**9,000**	**7,250**	**6,000**	**22,250**

Relationship of FY 2008 President's Request to the FY 2007 President's Request

Requested levels of funding in the FY 2008 President's request would provide funding not only for the FY 2008 initiatives described in further detail in this budget document, but also would provide the resources originally requested in the FY 2007 President's request for NIST in support of the President's ACI. The ACI proposes to double investments over 10 years in key Federal agencies (NIST, the National Science Foundation, and the Department of Energy Office of Science) that support basic research programs in the physical sciences and engineering. In FY 2007, NIST requested an increase of $72 million, 166 permanent positions and 124 FTE in STRS budget as part of the ACI to address the following major initiative components:

Enabling Nanotechnology from Discovery to Manufacture	$20,000,000	34 FTE
NIST Center for Neutron Research Expansion and Reliability Improvements: A National Need	$10,000,000	9 FTE
Enabling the Hydrogen Economy	$10,000,000	25 FTE
Manufacturing Innovation through Supply Chain Integration	$2,000,000	4 FTE
Quantum Information Science – Infrastructure for 21st Century Innovation	$9,000,000	17 FTE
Structural Safety in Hurricanes, Fires, and Earthquakes	$2,000,000	3 FTE
Synchrotron Measurement Science and Technology: Enabling Next Generation Materials Innovation	$5,000,000	5 FTE
International Standards and Innovation: Opening Markets for American Workers and Exporters	$2,000,000	5 FTE
Innovations in Measurement Science	$4,000,000	2 FTE
BioImaging: A 21st Century Toolbox for Medical Technology	$4,000,000	8 FTE
Cyber Security: Innovative Technologies for National Security	$2,000,000	9 FTE
Biometrics: Identifying Friend or Foe?	$2,000,000	3 FTE

Detailed descriptions of these initiative components can be found in the FY 2007 Presidential Request budget submission. A short, summary description of each follows:

Initiative Components

Enabling Nanotechnology from Discovery to Manufacture (+$20,000,000): NIST will develop and make available the world's most advanced nanoscale measurement and fabrication methods to partners from industry, universities, and other government agencies through the full establishment of the Center for Nanoscale Science and Technology (CNST). Furthermore, NIST will establish the materials and process characterization, including development of reference materials and reference data, to enable scaled-up, reliable, and cost-effective manufacturing of nanoscale materials, structures, devices, and systems.

NIST Center for Neutron Research Expansion and Reliability Improvements: A National Need (+$10,000,000 in STRS, +$12,000,000 in CRF): NIST will expand capacity and improve the NCNR by developing better hydrogen cold source and optical systems to deliver more neutrons to the instruments; developing a neutron scattering instrument to enable new, more sensitive, higher spatial resolution analytical tools; and improving facility maintainability and reliability by replacing aging control systems.

Enabling the Hydrogen Economy (+$10,000,000): NIST research will enable more powerful, efficient, and durable fuel-cell designs and high-volume manufacturing through the development of measurement tools, material characterization, theory, and models that allow real-time diagnostics of hydrogen fuel cell performance; ensure accurate measures of hydrogen at points of sale; and ensure safer storage, distribution, and delivery of hydrogen in the marketplace.

Manufacturing Innovation through Supply Chain Integration (+$2,000,000): This initiative will advance industry towards a seamless global supply chain — shortening design-to-manufacturing cycle, improving product quality, and lowering costs. NIST will develop standards, measurements, and testing tools that are fundamental to enabling efficient supply chains, maintaining competitiveness, and increasing innovation.

Quantum Information Science - Infrastructure for 21st Century Innovation (+$9,000,000): This initiative is comprised of two complementary efforts aimed at accelerating the development of quantum information science: 1) an expanded in-house program to develop the measurement science, standards, and technology for quantum information science and 2) establishment of the Joint Quantum Institute, a strategic partnership between NIST, a university, and the National Security Agency, to leverage the strengths of these organizations. These efforts will help to secure America's lead in quantum information science by training the Nation's next generation of quantum science innovators, converting fundamental knowledge into technology, and ensuring U.S. leadership in developing a revolutionary new technology.

Structural Safety in Hurricanes, Fires, and Earthquakes (+$2,000,000): This initiative will enable a reduction in the risk of losses from extreme natural events by developing: 1) the technical tools required to enable innovations in multi-hazard risk assessment and mitigation technologies, and 2) the scientific basis to improve the codes and standards used in the design, construction, and retrofit of buildings and physical infrastructure.

Synchrotron Measurement Science and Technology: Enabling Next Generation Materials Innovation (+$5,000,000): This initiative leverages NIST's expertise in measurement science with the unique capabilities of the National Synchrotron Light Source (NSLS) at Brookhaven National Laboratory. This initiative will provide state-of-the-art measurement tools for characterizing the chemical and structural state of materials and devices through close collaborations with researchers from industry, academia, and other government agencies. These measurements enable materials-driven innovations across a broad spectrum of technology sectors, including nanotechnology, homeland security, energy, microelectronics, and magnetics.

International Standards and Innovation: Opening Markets for American Workers and Exporters (+$2,000,000): This initiative will support U.S. competitiveness and innovation by ensuring that U.S. businesses are equipped to satisfy standards-related requirements in key export markets in Asia and the Americas.

Innovations in Measurement Science (+$4,000,000): The NIST Innovations in Measurement Science Program is one of NIST's primary mechanisms for keeping pace with the measurement requirements needed for innovation in U.S. industry. This program is used to advance NIST's capabilities in the core measurement science areas underpinning technology innovation. Just as industry must innovate to survive in a competitive environment, NIST must develop innovative approaches to measurement challenges. NIST uses this program to anticipate industry needs and develop the measurement science needed by the next generation of technology. The increased funding would mean more and faster measurement innovation to meet emerging industry needs.

BioImaging: A 21st Century Toolbox for Medical Technology (+$4,000,000): Measurement science and standards are needed to drive innovation in imaging systems, enabling the change from observation to quantitative diagnosis and noninvasive treatment tools reducing the need for biopsies and other invasive procedures. This requires an interdisciplinary approach marrying the physical, biological, and information sciences. Partnering with the National Institutes of Health and the bioimaging industry, NIST will utilize its expertise in the physical and information sciences to provide the necessary measurements and standards to pave the way for innovative diagnostics.

Cyber Security: Innovative Technologies for National Security (+$2,000,000): Without the necessary metrics and measurement technologies, we lack the ability to determine whether our efforts at securing the Nation's infrastructure are achieving the desired result. NIST will collaborate with industry and academia to develop metrics and measurement techniques for characterizing known

and unknown vulnerabilities. Together with tools to predict expected behavior, these methodologies will provide mechanisms to assign security confidence levels, to measure improvements in the overall security of a system, and to identify and mitigate would-be attackers.

Biometrics: Identifying Friend or Foe? (+$2,000,000): NIST will develop measurements and standards to support testing and evaluation of enhanced biometric systems including approaches using multiple modes of identification.

A crosswalk of the FY 2007 STRS initiative requests by budget line item follows:

Crosswalk of FY 2007 STRS Requested Increases to Budget Subactivities/Line Items
(Dollars in thousands)

STRS Initiative Name	NIST Laboratories										Total
	Laboratories and Technical Programs								National Research Facilities		
	Manufacturing Engineering	Chemical Science & Technology	Physics	Material Science & Engineering	Building & Fire Research	Computer Science & Applied Mathematics	Standards & Technology Services	Innovations in Measurement Science	NIST Center for Neutron Research	Center for Nanoscale Science & Technology	
Physical Science to Enable Innovation: A Measurement Science and Standards Initiative											
Enabling Nanotechnology from Discovery to Manufacture										20,000	20,000
NCNR Expansion and Reliability Improvements: A National Need[1]									10,000		10,000
Enabling the Hydrogen Economy			10,000								10,000
Manufacturing Innovation through Supply Chain Integration	2,000										2,000
Quantum Information Science - Infrastructure for 21st Century Innovation			9,000								9,000
Structural Safety in Hurricanes, Fires, and Earthquakes					2,000						2,000
Synchrotron Measurement Science and Technology: Enabling Next Generation Materials Innovation				5,000							5,000
International Standards and Innovation: Opening Markets for American Workers and Exporters							2,000				2,000
Innovations in Measurement Science								4,000			4,000
BioImaging: A 21st Century Toolbox for Medical Technology		4,000									4,000
Cyber Security: Innovative Technologies for National Security						2,000					2,000
Biometrics: Identifying Friend or Foe?						2,000					2,000
Total, STRS FY 2007 Initiatives by Subactivity and Line Item	**2,000**	**4,000**	**19,000**	**5,000**	**2,000**	**4,000**	**2,000**	**4,000**	**10,000**	**20,000**	**72,000**

[1] A Construction of Research Facilities (CRF) initiative of $12 million is affiliated with this NCNR STRS initiative

The FY 2007 President's request includes an initiative of $20,100,000 in the CRF appropriation requested as part of the President's ACI. The requested increase includes $10,100,000 for Boulder construction projects. NIST proposes to amend the request to initiate the design for the construction of a Building 1 Extension (B1E) at a cost of $3,500,000 and to initiate site infrastructure in support of the B1E at a cost of $6,600,000. It also includes a base increase of $10,000,000 for Safety, Capacity, Maintenance, and Major Repairs. The increase in the annual facilities maintenance and repair budget will allow NIST to address the backlog of major repair work and to forestall more costly emergency repairs in the future at the NIST main sites in Gaithersburg, Maryland and Boulder, Colorado; and the NIST field sites in Fort Collins, Colorado and Kauai, Hawaii.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Construction of Research Facilities
INCREASE FOR FY 2008
(Dollar amounts in thousands)

		2008 Base		2008 Estimate		Increase/(Decrease) Over 2008 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Total, American competitiveness initiative[1]	Pos./Approp			53	$69,250	53	$69,250
	FTE/Obl.			40	66,750	40	66,750
1. Building 1 extension (B1E)	Pos./Approp			0	28,000	0	28,000
(Construction and major renovations)	FTE/Obl.			0	28,000	0	28,000
2. NIST center for neutron research (NCNR) expansion and reliability improvements	Pos./Approp			0	19,000	0	19,000
(Construction and major renovations)	FTE/Obl.			0	19,000	0	19,000
Total, American competitiveness initiative Construction of Research Facilities	Pos./Approp			0	47,000	0	47,000
	FTE/Obl.			0	47,000	0	47,000

[1] Includes both $47 million in Construction of Research Facilities funding and $22.25 million in Scientific and Technical Research and Services funding.

ACI CRF components:

1. Building 1 extension (B1E) - Providing the Tools of Science to Support Sustained Scientific Advancement and Innovation (Appropriation +$28,000,000, Direct Obligations +$28,000,000)

"Sustained scientific advancement and innovation are key to maintaining our competitive edge, and are supported by a pattern of related investments and policies, including ... Federal investment in the tools of science—facilities and instruments that enable discovery and development..." *American Competitiveness Initiative, February 2006*

- NIST proposes to construct unique, high-performance laboratory space with stringent control of temperature, vibration, humidity, and air cleanliness needed to provide the measurement infrastructure that will enable the scientific progress and technical advance that will bring the Nation economic security and industrial competitiveness in the 21st century.

- This modification to the current facilities improvement plan for the Boulder location reduces costs, improves performance of laboratory space, and delivers this higher performance laboratory space more quickly.

- The improved space will enable NIST to support scientific discovery and technical development of transformational technology in homeland security, telecommunications, nanotechnology, precision timing, hydrogen energy sources, precision electrical standards, biotechnology, applications of lasers, electromagnetic interference testing, quantum computing and quantum communications, and other national needs.

- This enhanced laboratory space will be achieved through extending Building 1–the main NIST-Boulder laboratory facility–with highest performance new laboratory space, combined with renovating parts of the existing Building 1 laboratories to moderate performance levels.

- Failure to act will limit the ability of NIST to provide the technical infrastructure to support disruptive technologies that are critical to the future economic security and industrial competitiveness of the Nation.

Problem Magnitude and NIST Role:

Scientific and technical progress demand increasingly accurate and precise measurements. For example, NIST scientists invented atomic clocks which have enabled the Global Positioning System (GPS), high capacity telecommunications, synchronization of electric

power grids, and many other key technologies and infrastructures supporting national needs and promoting U.S. innovation. Planned improvements by NIST-Boulder scientists to atomic clock accuracy by a factor of 100 or more–to the equivalent of one second in 30 billion years–will enable improvements in these applications and create new applications in a wide range of precision measurements. Next generation innovations in national priorities such as nanotechnology, homeland security, telecommunications, materials testing, electrical and electronic measurements, timing and synchronization, electromagnetic interference, biotechnology, and many other areas currently require similar progress in the unique, world-leading research and measurements performed by NIST-Boulder laboratories.

Even the smallest changes in laboratory conditions can disrupt existing and planned NIST-Boulder research and metrology programs that require extremely sensitive measurements, such as:

- Measurements of properties of materials at the single atom level to support nanotechnology research and development as part of the National Nanotechnology Initiative.
- Stringent timing and synchronization measurement to be provided by next-generation atomic clocks that will perform at the 10^{-18} second uncertainty level (equivalent to one second in 30 billion years) and will support a wide range of future commercial and security applications, including telecommunications, higher-performance GPS, high-speed computing, space exploration, and scientific research.
- Measurement of forces equivalent to less than a billionth of a gram to study how cells and molecules function for new knowledge in biotechnology and health care.
- Precision counting of streams of photons (individual particles of light) to support research on secure quantum communications.
- World-leading electrical measurements and standards based on nanoscale devices that can count or control individual electrons – the smallest unit of electricity that can enable novel designs, function and speed beyond current capabilities.
- Control of hundreds of ions (electrically charged atoms) spaced by millionths of an inch to develop powerful quantum computers.

The demand for high-performance lab space is strong. NIST has completed major repairs to support certain Boulder facilities such as the Advanced Clean Room and Ion Storage Laboratory. The fact that these facilities remain oversubscribed demonstrates a strong demand for high-performance laboratory space from the NIST customer base. Further, these limited major repair projects have validated external estimates of cost. This experience indicates that there is a strong demand for high-performance laboratory space and that the proposed modifications to the Facilities Improvement Plan would deliver these facilities at a lower cost to the Nation.

NIST-Boulder laboratories are outdated and in need of major repair. Increasing the accuracy and the precision of measurements critical to next generation scientific and technical advancements demands stringent environmental control beyond the current capabilities of NIST-Boulder laboratories. Recent funding has enabled NIST-Boulder to make excellent progress in improving the utility infrastructure; however, NIST-Boulder requires additional funding to complete the necessary facility improvements required to fulfill NIST's key role in the American Competitiveness Initiative.

NIST-Boulder has reviewed the capabilities of current laboratory space and reviewed the technical requirements of the laboratory space that is needed to support the scientific progress and technical advance that will bring the Nation economic security and industrial competitiveness in the 21st century. NIST has estimated how much laboratory space is needed at NIST-Boulder for six different laboratory performance levels, labeled L1 through L6 from least demanding performance specifications through most stringent performance. The estimated needs for usable laboratory space, that is Net Assignable Square Feet (NASF) of laboratory space, and performance needs are summarized in Table 1.

Table 1: NIST-Boulder Advanced Laboratory Space Requirements and Current Capabilities

	General Lab Level 1 (L1)	General Lab Level 2 (L2)	General Lab Level 3 (L3)	High Performance Lab (L4)	Instrument Lab (L5)	Precision Metrology Lab (L6)
Temperature Control (°C)	+/- 2	+/- 1	+/- 0.5	+/- 0.5; +/- 0.25 in an enclosure	+/- 0.25	+/- 0.1
Relative Humidity Control	NA	+/- 20%	+/-2 0%	+/- 10%	+/- 5%	+/- 5%
Air Filtration Class	100,000	100,000	10,000	10,000	100	100
Vibration Control (micrometers/second)	Insensitive	12.5	< 12.5	6	3	< 3
Current NIST-Boulder Lab Capabilities (NASF)	139,930	39,100	3,900	*	*	*
NIST-Boulder Lab Needs Assessment (NASF)	39,000	12,500	78,700	25,400	8,300	14,300

**Note: No existing NIST-Boulder laboratory space meets performance specifications above L3.*

NIST-Boulder facilities comprise approximately 411,561 NASF of laboratory and office space of different performance levels. Most of the 50-year-old NIST-Boulder laboratory space does not even meet the minimal L1 "General Laboratory Level 1" performance requirements. Barely one third of current NIST-Boulder laboratory space meets the L1 performance level. Less than ten percent of current lab space meets the L2 performance level and only after extensive, costly, and time-consuming renovations does about 1 percent of existing laboratory space meet the L3 performance level specifications. No existing NIST-Boulder laboratory space meets performance specifications above L3.

Poor laboratory environmental controls inhibit productivity and impose significant costs on the Nation. NIST scientists conservatively estimate an approximate 20 percent loss of productivity due to poor control of temperature, vibration, air cleanliness, and other laboratory conditions. In the existing 50-year-old NIST-Boulder Laboratory facilities, much of this research and measurement cannot be conducted at all. Even for the limited range of work that can be attempted, current laboratory conditions create significant inefficiencies. Much research and many measurements can only be conducted sporadically when environmental conditions are temporarily stable, and much experimental data and construction of nanoscale devices becomes worthless because of corruption due to poor laboratory conditions. This reduced productivity represents a direct loss of about $13 million per year to NIST-Boulder laboratory programs. But the impact on the Nation is much greater. Based on more than 30 economic impact studies (http://www.nist.gov/director/planning/summary-studies.htm) of NIST measurements, this direct $13 million productivity loss for NIST results in at least $130 million per year in lost economic productivity to U.S. industry that relies on NIST-Boulder measurements and standards to support innovation and production. NIST-Boulder requires improved facilities to fulfill its mission. By this measure, the approximately $66 million investment required to build the B1E would be repaid in the first year of operation of the new facilities. Much research and measurement planned for the future will likewise not be possible without upgraded facilities, resulting in even greater economic and innovation losses to the Nation. World-leading NIST-Boulder research and measurements require high-performance laboratory space with stringent environmental controls.

Specific examples of limitations of current NIST-Boulder laboratory performance include:

- NIST attempts to perform high-speed measurements of electronic systems operating at frequencies beyond 100 GHz (100 billion cycles per second) for advanced telecommunications, new radar systems, high-speed computing, and many other crucial applications. Temperature drifts of even 0.5 °C (about 1 °F) in the measurement laboratories introduce so much "jitter" that the measurements above 50 GHz cannot be conducted at all, failing to meet the needs of industry and other agencies. Even the measurements below 50 GHz cannot be performed approximately 15 percent of work days because temperature drifts are too large. Additionally, the needs of industry and other agencies continue to become more stringent. NIST customers will need reliable measurements at up to about 500 GHz within five to ten years, and NIST will not be able to provide those measurements in the current facilities.

- To meet the needs of semiconductor device manufacturers as feature sizes continue to shrink, NIST is developing methods to test reliability, stability, and materials properties at the single atom level. NIST is also developing nanoscale measurement science and technologies for biological systems, to probe cells and sub-cellular structures to help medical researchers better understand disease, the action and metabolism of drugs, and cell-repair processes. These types of metrology and research require sensitive measurements of force (equivalent to less than a billionth of a gram) and position (less than one nanometer, the size of a few atoms), requiring the most stringent possible control of temperature, vibration, and cleanliness–levels of performance not possible in the existing facilities.

- NIST-Boulder has unique nanoscale fabrication facilities designed to make special devices for internal NIST use in research and measurements. On at least 20 percent of working days throughout the year, temperature and humidity variations in the laboratory prevent the fabrication of critical nanoscale devices, causing repeated delays and inefficiencies, and limiting the performance of NIST research and measurements. Examples of NIST's expertise in fabricating nanoscale devices for critical national priorities include:
  - Quantum dots, nanoscale structures that can produce controlled streams of photons (light particles) used for NIST's world-class program in secure quantum communications;
  - Special detectors that can count individual photons for use in secure quantum communications and ultra sensitive detection of contaminants and dangerous materials;
  - New technologies for high-efficiency solid-state lighting that could reduce electric power consumption, saving the U.S. more than $100 billion in energy costs by 2025;
  - New "nanowire lasers" that could provide microscopic, highly-efficient lasers over a very wide spectral range for new applications in telecommunications, medical procedures, quantum computing, and many other areas;
  - The world's best-performing solid-state quantum computing devices (qubits) and unique electromagnetic traps for ions (charged atoms), both devices crucial for research on making computers more powerful than today's best supercomputers for applications in cryptography, modeling of complex materials and systems, near-instantaneous searching of vast databases, climate modeling, and other applications;
  - Unique detectors for x-rays that could be used to remotely sense nuclear materials, such as nuclear weapons or "dirty bomb" material being concealed in shipping containers;
  - Special detectors for terahertz radiation–electromagnetic radiation beyond the infrared–for possible detection of concealed weapons; and
  - Ultra miniature atomic clocks the size of a grain of rice to dramatically improve the performance of wireless communications, make GPS more accurate and jam resistant, and detect magnetic fields produced by hidden weapons.

- Stringent timing and synchronization supports a wide range of commercial and security applications, including telecommunication, GPS, high-speed computing, space exploration, and scientific research. To meet the demands of new systems under development for industrial and security applications, NIST conducts research on future atomic clocks that will perform at the 10^{-18} second uncertainty level (equivalent to about one second in 30 billion years), using the science and technology of laser frequency combs developed in part by 2005 NIST Nobel Laureate Dr. John Hall. However, temperature instabilities and vibration often mean only 10 percent or less of the data and measurements are useful. Temperature control of 0.1 °C and stringent vibration isolation will be needed to make these research ideas a reality.

- NIST performs sensitive measurements of how electromagnetic noise (interference) affects crucial electronic and communications equipment, including equipment for emergency responders, military navigation and communications equipment, space shuttle avionics, medical equipment, and many other instruments. However, variation in temperature in the testing laboratories also produces electromagnetic noise, making it impossible to directly measure the sensitivity of the equipment under test. These temperature fluctuations result in a minimum of 20 percent productivity loss delaying results to key customers in industry and other agencies who need NIST measurements to produce, certify, and field their products and systems.

- Electrons are the individual particles of electrical current, with each electron having an unimaginably small charge. Yet NIST scientists have developed the world's only systems to count individual electrons among very large electron collections for world-leading precision in measurement of current, voltage, capacitance, and other crucial electrical quantities. Such measurements are crucial for a wide range of electronic systems, telecommunications systems, measurement instruments, and scientific research. NIST electron-counting research and measurement programs are limited by unstable laboratory temperatures, impairing full adoption of this very powerful technique.

- NIST-Boulder scientists are pioneering the use of microwaves to make tests and measurements at the nanoscale. These measurements are crucial to such applications as digital wireless communications systems for commercial and emergency responder applications, new methods to measure and control biological specimens for medical research, and non-destructive testing and evaluation of semiconductor devices on the wafer, before the device has been completed and found to have problems. These sensitive measurements require temperature stability of about 0.1 °C, which cannot be obtained in the existing NIST-Boulder facilities. As these measurements are applied to nanoscale features, they become increasingly sensitive to vibration, and are rendered useless even by nearby movement of furniture or people walking along hallways. Currently, NIST scientists are able to eke out only a few meaningful measurements, usually late at night when environmental vibrations are reduced, reducing efficiency and productivity, and limiting research and measurements to support new applications.

Problems due to poorly-performing laboratory facilities directly affect NIST's customers in industry and other Federal agencies. A partial list of other Federal agencies relying on NIST-Boulder research and measurements to fulfill their missions includes Department of Defense, Department of Energy, Department of Homeland Security, Defense Advanced Research Project Agency, National Aeronautics and Space Administration, National Institutes of Health, National Oceanic and Atmospheric Administration, Department of the Interior, Department of Justice, Department of Transportation, Federal Communications Commission, Food and Drug Administration, Occupational Safety and Health Administration, and Environmental Protection Agency. The ability of NIST-Boulder scientists to support these agencies is already compromised by poorly-performing laboratory facilities, and the problem will continue to worsen as more stringent measurements and research will be required.

Current NIST-Boulder renovation plans are not cost effective and current laboratory space cannot be retrofitted to the highest performance level. In 1997, Booz Allen Hamilton estimated the cost of renovating existing NIST-Boulder laboratory space to different performance levels. The contractor estimated the cost of renovation to levels L1 through L5 per Gross Square Foot (GSF) as indicated in Table 2. The costs have been adjusted to 2006 dollars. Because higher performance laboratory space (such as L4 and above) requires a greater amount of support space for the building infrastructure providing tighter control of temperature, humidity, vibration, and air cleanliness, usable lab space (NASF) is less than the total space constructed (GSF).

Table 2: Estimated Costs for Stand-Alone Renovation Projects

	General Lab Level 1 (L1)	General Lab Level 2 (L2)	General Lab Level 3 (L3)	High Performance Lab (L4)	Instrument Lab (L5)	Precision Metrology Lab (L6)[2]	Total
NIST-Boulder Lab Needs Assessment (NASF)	39,000	12,500	78,700	25,400	8,300	14,300	178,200
Estimated Requirement (GSF)	55,700	17,900	131,200	50,800	20,750	35,750	312,100
Estimated Renovation Cost (per GSF)	$284	$391	$453	$551	$872	$1,160	
Estimated Total Renovation Cost ($million)	$15.8	$7.0	$59.4	$28.0	$18.1	$41.5	$169.8

Note: Booz Allen Hamilton did not provide estimated costs for renovation to the L6 performance level; based on the complexity and required performance of L6 space it is clear that renovation to the L6 level would cost more per Gross Square Foot (GSF), if it can be done at all.

To provide the metrology infrastructure to support scientific progress and technical advances that will bring the Nation economic security and industrial competitiveness in the 21st century, NIST considered three options: pursuing status-quo renovation plans; constructing new facilities; and combining renovation with new construction. NIST has chosen the third option, combining renovation with new construction, in order to maximize the benefit from existing facilities and minimize the cost of providing advanced laboratory space to meet industrial and scientific needs.

[2] The estimated renovation cost per GSF for L6 space is extrapolated from the average increases in renovation costs for the L1-L5 performance levels.

The total cost to renovate approximately 48,000 NASF of *existing* laboratory space to L4-L6 performance levels is about $87.6 million ($28.0 million for renovation to L4 plus $18.1 million for renovation to L5 plus $41.5 million for renovation to L6). However, the cost estimate to construct *new* laboratory space at NIST-Boulder comprising 48,000 NASF of L4, L5, and L6 performance space indicates a total cost of about $76.2 million (including design). Thus for an estimated *13 percent cost savings*, NIST can construct new laboratory space at the L4 through L6 levels with *better overall performance* compared to renovating existing space. This higher performance space can be delivered *more quickly* than under the previous Facilities Improvement Plan, which provides for only renovations of existing space.

This proposal is part of an overall Facilities Improvement Plan that includes *optimal* renovation of existing NIST-Boulder laboratory space to provide some of the L1 through L3 laboratory performance needs outlined in Table 1. The majority of NIST-Boulder measurement and research programs require higher-performing laboratory space than the current facilities (L1 through L3) can provide, although not the highest-performing space required by programs slated for the B1E (L4 through L6). Constructing the B1E will address needs for the highest-performing laboratory space (L4 through L6) more cost-effectively than possible through renovations. NIST estimates that constructing the B1E and performing limited renovations of existing space will cost a total of $142.4 million–a cost savings of approximately $19.1 million over the current Facilities Improvement Plan to conduct renovations only. Construction of the new B1E plus limited renovations will provide higher performance laboratory space than would be possible through renovations alone, at a significant overall cost savings.

Proposed NIST Technical Program:

To meet the technical specifications needed to support continued scientific progress and technical advance that are crucial to national economic security and industrial competitiveness in the 21st century, NIST has chosen to combine the construction of new laboratory facilities, renovation, and major repair of existing facilities. Pre-existing major renovation plans were not cost-effective and failed to deliver the highest performance laboratory space. Construction of new facilities to meet all laboratory needs proved to be prohibitively expensive as well. Construction of new laboratory space, with the highest level of environmental controls, *costs less* than renovating existing space to meet these performance requirements, *delivers higher performance* space than renovations alone could provide, and will make that high performance space available *more quickly* than under the previous plan. For these reasons, NIST-Boulder proposes to construct a limited amount of high-end laboratory space (L4-L6). When renovation is less costly than new construction, NIST will renovate. NIST-Boulder will renovate existing laboratory space to meet the less stringent environmental control requirements of general lab space (L1-L3).

NIST proposes to design and construct the new B1E to meet the needs for the most demanding research and measurements conducted at the NIST-Boulder laboratories. The B1E will represent approximately 48,000 NASF (approximately 137,000 GSF) of advanced laboratory space with stringent control of temperature, vibration, humidity, and air cleanliness.

The total cost of constructing the B1E is estimated at $76.2 million, with $28.0 million needed in FY 2008 and an additional $38.1 million needed in FY 2009. The FY 2007 President's budget includes a request for a total of $10.1 million for Boulder construction projects. NIST proposes to amend the FY 2007 President's request to initiate the design for the construction of the B1E at a cost of $3.5 million. Also proposed for amendment is an increase of $6.6 million to initiate site infrastructure work in support of the B1E project.

The development of the B1E comprises five main stages over approximately four years:

- Architectural design of B1E based on detailed specifications (approximately 3 months)
- Solicitation of bids for construction of B1E and award of construction contract (approximately 12 months)
- Construction of B1E (approximately 24 months)
- Final building inspection and acceptance (approximately 3 months)
- Fit-up, communications systems installation and relocation of equipment (approximately 6 months)

Performance Measures: Outputs

At the proposed two-year funding level, NIST will generate the following outputs:

Building 1 extension	
Technical Area	**Outputs**
Construction of B1E at the NIST-Boulder site	• Complete architectural and engineering design of the B1E with approximately 48,000 NASF of high performance laboratory space (2008). • Award contract for construction of the B1E (2009). • Complete construction of the new laboratory facility (2011). • Conduct acceptance testing of the new laboratory and final fit up and relocation (2012).

Performance Measures: Outcomes

At the proposed funding level, NIST will generate the following outcomes:

NIST-Boulder laboratory programs will be able to support key national technology priorities in nanotechnology, homeland security, new energy sources, biotechnology, and many other areas. The expected improvement in the efficiency of existing NIST-Boulder research and measurement programs will have an estimated $130 million annual impact on the U.S. economy–a return that more than pays for the new facilities investment in one year. That estimate of economic impact does not include the expected dramatic impact of new NIST-Boulder research and measurements that are impossible in the existing lower-performance facilities, but will be enabled by the new laboratory.

Scientific progress and technical advances demand increasingly accurate and precise measurements that are not available anywhere in the world. NIST-Boulder laboratories lack the stringent environmental control needed to deliver critical measurements ranging from time to electrical quantities to materials properties to electromagnetic interference. By providing high performance laboratory space, NIST-Boulder will develop the measurement infrastructure needed to give domestic industry a unique resource to enhance domestic innovative capacity and foster scientific discovery and technological innovation which have driven about half of U.S. economic growth. NIST's job is to provide U.S. manufacturers and scientists with "world standard" templates that are indispensable to enable new generations of science, technology, and competitive products.

The technologies that will define the first half of the 21st century–nanotechnology, bioscience and information technology among them–rely to an unprecedented degree on measurement capabilities that push the limits of science. They will not be accomplished in laboratories with 50-year old systems that are well past their life expectancy and cannot be cost-effectively renovated to 21st century research and measurement capabilities.

Current Opportunity Costs:
The costs to the Nation of not pursuing this initiative are high. NIST's ability to support crucial areas of innovation is severely impaired by 50-year-old NIST-Boulder laboratory facilities that cannot support 21st century research and measurements. The *status quo* puts at risk NIST's ability to support the development of disruptive technologies in homeland security, telecommunications, nanotechnology, precision timing, hydrogen energy sources, precision electrical standards, biotechnology, applications of lasers, electromagnetic interference testing, quantum computing and quantum communications, and other national needs. These advancements are critical to the future economic security and industrial competitiveness of the Nation.

2. NIST center for neutron research (NCNR) expansion and reliability improvements (Appropriation +$19,000,000, Direct Obligations +$19,000,000)

Problem Magnitude and NIST Role:

The NCNR is widely regarded as the most cost-effective neutron facility in the United States and is currently the Nation's leading neutron research facility, serving more scientists and engineers than all other U.S. facilities combined. Neutron scattering techniques, in which high intensity beams of neutrons are used as a probe to "see" the structure and dynamics of materials at the nano-scale, are some of the most powerful measurement tools available. The role of the NCNR is to develop and apply neutron measurement techniques to problems of national importance. The quality and quantity of NCNR research consistently rank among the best in the world.

NIST has an opportunity to address a critical national need in a cost-effective manner by expanding the use of the existing facility. This is a continuation of an effort begun in FY 2007 to develop and install a new "cold" neutron source, which when combined with a neutron guide tube network, converts one usable neutron beam into at least five. This expansion requires new instruments that would be fed by the additional neutron beams and a new guide hall in which to house these instruments. This would augment NIST's neutron measurement capacity without the prohibitive cost of constructing a new facility, which is estimated to exceed $800 million. Central to the strategy of leveraging the existing NIST source is ensuring that the reliable operation of the facility continues over its useful life, which will be at least an estimated additional 20 years.

Proposed NIST Technical Program:

In FY 2008, this initiative will fund construction of a new Guide Hall and supporting facilities. The Guide Hall is a dedicated facility to house the neutron beam delivery system and neutron scattering instruments that are part of this expanded Center for Neutron Research.

- This initiative will provide for the construction of the new guide hall that will house the neutron instruments, and provide needed supporting facilities. The guide hall facility will be approximately 18,000 square feet of industrial high-bay type space with sufficient floor loading capacity, utilities, material handling systems, and support space suitable for housing five new neutron instruments, a neutron guide tube network, associated radiation shielding, ancillary equipment, cold source refrigeration systems, support storage and sample preparation space suitable to support a robust neutron scattering research program.

- The new guide hall must attach to existing structures while meeting security requirements for personnel access and regulatory requirements regarding the function of the facility's confinement building system. The expansion of the NCNR with these new instrument capabilities will also result in a modest staffing increase of approximately 25 staff or long-term guest researchers to operate

and support the neutron instruments and assist the large number (over 500 per year) of new researchers who will visit the facility over shorter durations to perform measurements on the new instruments.

- To accommodate regulatory and security requirements to control access to the facility, it is essential that new supporting facilities be physically connected to the existing building. The new supporting facilities will also provide space for a visitor/security check-in point that is needed to maintain rigorous access controls to the facility. The building and surrounding features must meet security requirements to control personnel access to the building and to control vehicular access to areas near the building.

Performance Measures: Outputs

At the proposed funding level for FY 2008, NIST will generate the following outputs:

NIST center for neutron research (NCNR) expansion and reliability improvements	
Technical Area	**Outputs**
Construction of new facilities	Construction of new guide hall and supporting facilities for the NCNR expansion

Performance Measures: Outcomes

At the proposed funding level, NIST will generate the following outcomes at the completion of the project:

- An additional 500 research participants and 75 more scientific publications per year.
- A 50 percent increase in the number of cold neutron beams suitable for use by next-generation neutron scattering instruments.
- Five new, world-class neutron instruments for U.S. researchers.

The demand for atomic and nanoscale characterization enabled by cold neutron scattering far exceeds the current capacity, and is expected to increase. The FY 2008 initiative to construct a guide hall and add 5 new instruments to utilize the new neutron source begun in FY 2007 will go a long way towards meeting this need and will provide a competitive advantage to U.S. researchers who have access to the facility. Access to the NCNR is granted by a competitive proposal process, which ensures the research enabled will have the greatest impact.

OUTYEAR FUNDING ESTIMATES (Budget Authority In Thousands)								
	FY 2006 & Prior	**FY 2007**	**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**	**Estimate to Complete**	**Total Program Estimate**
Change from FY 2008 Base								
Building 1 extension		10,100	28,000	38,100			76,200	76,200
NIST center for neutron research (NCNR) expansion		12,000	19,000				31,000	31,000

**Outyear costs are estimates and are subject to change. Future requests will be determined through the annual budget process.*

Exhibit 15

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Construction of Research Facilities
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Construction and major renovations
Subactivity: Construction and major renovations
Program Change: American competitiveness initiative

Object Class		2008 Increase/ (Decrease) Obligations
11	Personnel compensation	
11.1	Full-time permanent	$0
11.9	Total personnel compensation	0
12.1	Civilian personnel benefits	0
21	Travel and transportation of persons	0
22	Transportation of things	0
23.3	Communications, utilities and miscellaneous charges	0
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	0
25.3	Purchases of goods and services from Government accounts	0
25.5	Research and development contracts	0
25.7	Operation and maintenance of equipment	0
26	Supplies and materials	0
31	Equipment	0
32	Land and structures	47,000
41	Grants, subsidies and contributions	0
99	Direct obligations	47,000
	Transfer to NIST Working Capital Fund	0
	Total increase requested	47,000

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
INCREASE FOR FY 2008
(Dollar amounts in thousands)

		2008 Base[1]		2008 Estimate		Increase/(Decrease) Over 2008 Base[2]	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Total, American competitiveness initiative.....	Pos./Approp					56	$69,250
	FTE/Obl.					42	66,750
National research facilities							
1. Enabling nanotechnology from discovery to manufacture	Pos./Approp	46	$20,000	61	$26,000	15	6,000
(Center for nanoscale science and technology)	FTE/Obl.	34	17,000	45	22,000	11	5,000
Laboratories and technical programs							
2. Enabling innovation through quantum science.....	Pos./Approp	22	9,000	35	13,000	13	4,000
(Physics)	FTE/Obl.	17	8,000	27	11,500	10	3,500
3. Measurements and standards for the climate change science program.....	Pos./Approp	0	0	20	5,000	20	5,000
(Physics)	FTE/Obl.	0	0	15	4,000	15	4,000
4. Disaster resilient structures and communities	Pos./Approp	4	2,000	9	6,000	5	4,000
(Building and fire research)	FTE/Obl.	3	2,000	7	6,000	4	4,000
5. National earthquake hazards reduction program initiative	Pos./Approp	0	0	3	3,250	3	3,250
(Building and fire research)	FTE/Obl.	0	0	2	3,250	2	3,250
Total, American competitiveness initiative Scientific and technical research and services	Pos./Approp	72	31,000	128	53,250	56	22,250
	FTE/Obl.	54	27,000	96	46,750	42	19,750

[1] *Reflects ACI initiatives proposed in the FY 2007 President's budget.*
[2] *Includes both $47 million in Construction of Research Facilities (CRF) and $22.25 million in Scientific and Technical Research and Services (STRS) funding.*

American Competitiveness Initiative (ACI) STRS (+56 Permanent Positions, +42 FTE, Appropriation +$22,250,000, Direct Obligations +$19,750,000, Transfer to the Working Capital Fund +$2,500,000).

Technological innovation drives the Nation's economic growth and sustains our competitiveness in world markets. "Innovation will be the single most important factor in determining America's success through the 21st century," according to the Report of the National Innovation Initiative, Council on Competitiveness, December 2004. A 2005 National Academy of Sciences report, *Rising Above The Gathering Storm: Energizing and Employing America for a Brighter Economic Future,* states, "Economic studies conducted even before the information-technology revolution have shown that as much as 85 percent of measured growth in U.S. income per capita is due to technological change." New technologies require a sophisticated set of supporting tools to succeed. These tools include knowledgeable people with easy access to key information, national facilities and instruments that enable discovery and development, measurement science, and production technologies. NIST plays a fundamental role in ensuring access to this innovation toolset.

NIST's mission is to promote U.S. *innovation and industrial competitiveness* by advancing measurement science, standards and technology in ways that enhance economic security and improve our quality of life. This initiative provides the Nation with essential tools to enable continued innovation, competitiveness and economic vitality.

ACI STRS Components:

1. **Enabling Nanotechnology from Discovery to Manufacture (+15 Permanent Positions, +11 FTE, +$6,000,000, including $1,000,000 transfer to the Working Capital Fund)**

- The FY 2008 Administration Research and Development Budget Priorities highlights that, "Continued Federal investment in the agency programs that make up the National Nanotechnology Initiative (NNI) facilitates breakthroughs and maintains U.S. competitiveness in this field. The NNI should support both basic and applied research in nanoscience, develop instrumentation and methods for nanoscale characterization and metrology, and disseminate new technical capabilities, including those to help industry advance nanofabrication and nanomanufacturing."
- The United States faces dramatic changes in manufacturing, with nanoscale manufacturing expected to be a dominant factor in the 21st century. The promise of the U.S. investment and innovation in nanoscience and nanotechnology will be realized only if our Nation can cost-effectively put basic scientific discoveries to work in the production of superior nanotechnology products. The global impact of nanotechnology-related products is predicted to exceed $1 trillion by 2015.[2]

[2] M.C. Roco and W.S. Bainbridge, eds., 2001, "Societal Implications of Nanoscience and Nanotechnology", Springer, pp. 3-4.

- This includes: Materials $340 billion; Electronics $300 billion; Pharmaceuticals $180 billion; Chemicals $100 billion; Aerospace $70 billion; Healthcare $30 billion; and Tools $20 billion.
- Nanotechnology increases the value of existing products, enables new products, and fosters the growth of high-tech jobs in the U.S. economy of the future.
- The commercial development of new nanotechnologies depends on the availability of adequate nanoscale measurement methods.
- Through the new NIST Center for Nanoscale Science and Technology (CNST) and the NIST Laboratory programs, NIST will enable science and industry by providing essential measurement methods, instrumentation, and standards to support all phases of nanotechnology development, from discovery to production.

Problem Magnitude and NIST Role:

Manufacturing accounts for 14 percent of U.S. Gross Domestic Product and 11 percent of total U.S. employment. More significantly, the manufacturing sector generates the innovations that lead to productivity gains. Manufacturers are responsible for almost two-thirds of all private-sector R&D.[3] Over the past two decades, manufacturing productivity gains have been double those of other economic sectors. These productivity gains are integral to the U.S. economy's ability to compete globally, create new jobs, and make possible higher wages for U.S. workers.

Today, U.S industry faces many challenges to incorporating nanotechnology into advanced products and devices. Measurement of properties, imaging of structures, and modeling of behavior are all difficult at the nano-scale level. Each will require significant effort to avoid stifling the commercial development and manufacture of nano-structured products. However, the opportunities associated with these challenges are far reaching. Commercial incorporation of nanostructures will have dramatic effects in the U.S. microelectronics industry, magnetic storage industry, micro-electromechanical system industry, nanomaterials and nanocomposites industry, chemical sensor industry, and catalyst industry. Many of these industries exhibit greater than 15 percent cumulative annual growth rates that are sustained by nanotechnology advances. All depend on having the measurement methods and standards necessary to make progress in the nanotechnology dominated production environment of the future.

Proposed NIST Technical Program:

In FY 2007, NIST began a major initiative aimed at enabling the production of nanotechnology-based products by addressing the measurement barriers hindering the rapid development of nanotechnology. To date, important milestones have been met: the CNST was established, its new research division was staffed, and the CNST, a state-of-the-art, national nanofabrication and nanometrology user facility

[3] *National Science Foundation, "Research and Development in Industry," 2000.*

was brought on-line. A multi-year plan began with major FY 2007 initiatives in standards and measurements for nanomanufacturing, advanced two-dimensional structural imaging and characterization, high-frequency and high-resolution nanomagnetics imaging, and nanofabrication via advanced lithographic techniques. The proposed NIST technical program for FY 2008 progresses from these initiatives. For example, in the very important nanoscale characterization category, a three-dimensional imaging and characterization initiative builds upon the two-dimensional imaging and characterization program. Similarly, an initiative in measurements and standards to support ultimate-CMOS (Complementary Metal Oxide Semiconductor) circuitry builds upon the advanced lithography program.

As shown in the four areas below and discussed in the following text, NIST has planned a multi-year, measured build-up of the Nation's measurement and standards infrastructure to nurture and ensure U.S. leadership in the production and use of nanotechnology. The text following the table discusses each initiative planned for FY 2008.

Theme	FY 2007	FY 2008	FY 2009	FY 2010
Manufacturing	Nanomanufacturing reliability and standards	Mechanical properties of nanostructures	3D fabrication and assembly of nanostructures	Nanomanufacturing of Post-CMOS electronics
Characterization	Advanced 2D structural imaging and characterization	3D imaging and characterization of nanostructures	Atomic scale measurement and characterization	Bottom-up assembly of nanostructures
Devices	Nanomagnetics	Simulation and modeling of nanostructures	Measurements and standards in support of nanophotonics	Standards for nanobiological and nanomedical devices
Electronics	Advanced lithography–nanofabrication and soft lithography	Measurements and standards in support of ultimate CMOS	Measurements and standards in support of post-CMOS electronics	Measurements and standards in support of post-CMOS electronics

Mechanical Properties of Nanostructures: A crucial requirement for developing advanced devices incorporating nanostructures is quantitative knowledge of the mechanical properties of the materials and structures within a device. This type of knowledge is necessary for optimizing device design, materials selection, manufacturing processes and reliability predictions. The mechanical properties of materials in nanostructures are often difficult to estimate and may be very different from their bulk counterparts. In addition, the mechanical properties of nanostructures themselves are often difficult to measure, as the small length scales both preclude the use of many measurement techniques applied at larger scales and introduce new surface-related phenomena. Consequently, challenges exist for nanostructure

developers in the materials science of structure-properties relations for materials and in the metrology of mechanical properties of nanostructures. NIST will generate the measurement methods and standards for mechanical properties of nanostructures, focusing on those areas that will enable commercial development of new products including:

- Ultra-fast microelectronic devices to increase the speed and productivity of information technology,
- Very high-density magnetic storage devices with applications ranging from archival information storage to personal music players,
- Extended lifetimes of micro-electromechanical systems through effective lubrication of surfaces and interfaces, and
- Small-scale sensors, high-efficiency engines and rapid fabrication of nanostructures through the application of engineered surfaces.

Three-Dimensional Imaging and Characterization of Nanostructures: Measurement techniques must improve as structures continue to scale toward atomic dimensions and as new organizations of matter are engineered for functionality. These improved techniques are not only needed for the resolution of measurement, but also for the ability to discern three-dimensional complexity in the composition and arrangement of components within the structures. Characterization of the fine details of structure, chemical composition, and defect formation–in three dimensions with resolution appropriate to the nanostructure under study–presents an important and challenging measurement problem. Fundamentally new measurement capabilities that are beyond those achievable with current techniques will need to be devised and developed to meet these challenges for three-dimensional, non-destructive imaging and characterization. NIST will generate the measurement methods and standards for three-dimensional imaging and characterization that will:

- Enable existing industry sectors to see what they make at the nanoscale and thereby speed both the development phase–as new concepts are explored–and the manufacturing process–as the reliability of nanostructure production is enhanced;
- Allow the next generation drug delivery systems to be developed more rapidly and manufactured more reproducibly, because detailed structures can be imaged on the nanoscale; and
- Improve the quality of life because the health impacts of nanotechnology can be approached on a sound scientific basis. It will be possible to see nanostructures as they interact with their environment.

Simulation and Modeling of Nanostructures: Almost by definition, nanotechnology requires new models, simulations and theories to explain the new properties that arise as a consequence of the nanostructure's size. New models and simulations of the phenomena governing the manufacture and performance of nanostructures are required for nanostructure science to progress. Nanoscale structures are so far removed from the size scale accessible with human senses that their observation and measurement is very indirect, requiring an accurate and reliable model to bridge the huge gap in length scales. An overlapping series of models may be required because no single model will be applicable over this enormous range of sizes. Without a reliable theory, measurements of nanostructures become nearly impossible to

interpret. Additionally, in some cases, a measurement method has yet to be devised, and modeling alone will be relied on. NIST will develop methods for the simulation and modeling of nanostructures that will:

- Allow industry to reduce its product development cycle by providing a more accurate connection between the results of a measurement and the nanoscale phenomena being exploited;
- Allow for greater accuracy of measurement and thereby facilitate reliable and economical manufacture of products incorporating nanotechnology; and
- Help to advance the development of bottom-up assembly methods to allow the economical production complex nanodevices.

Measurements and Standards in Support of Ultimate CMOS: The semiconductor industry, one of the largest value-added manufacturing industries in the U.S., has been successful in employing miniaturization to increase performance of electronics at a constant cost. However, the process of miniaturization is ultimately limited by the discrete nature of matter and the prevalence of quantum phenomena as the atomic size scale is approached. The industry will continue to push current methodology as far as possible, to the endpoint of the development of CMOS technology, referred to as Ultimate CMOS. Developing the ultimate in CMOS technology will require major advances in nanoscale measurement and standards. NIST will partner with industry to provide the necessary measurements and standards to allow the development of Ultimate CMOS. This will:

- Give industry the measurements and standards tools needed to continue the rapid increases in semiconductor devices;
- Enable the development of advanced information technology to further enhance American productivity; and
- Facilitate the development of new sensors and high-speed electronics that strengthens our military and enhances the defense of the homeland.

Performance Measures: Outputs

At the proposed funding level, NIST will generate the following outputs:

Enabling nanotechnology from discovery to manufacture	
Technical Area	**Outputs**
Mechanical properties of nanostructures	• Methods for measuring the fracture, fatigue, and damage properties of nanostructures to improve reliability and determine how devices fail; • Methods for measuring stress and strain in nanostructures in order to reduce failure of devices and to permit the control of optical and electronic properties; • Measurement methods to facilitate the design of high strength materials incorporating nanocomposites; and • Measurements of the mechanical properties important to nanoscale energy conversion to further nanosensors and signal processing applications.
Three-dimensional imaging and characterization of nanostructures	• New methods for detection and location in three-dimensions of defects, inclusions, and other irregularities in nanoscale structures; • Fabrication of three-dimensional, nanoscale chemical compositional standard test structures with controlled elemental features; • Properties of nanoparticles, nanocrystals, and quantum dots used in 3D imaging applications; • New ultrasound holography instrument for high-resolution three-dimensional imaging; and • A super-resolution optical method, validated at the 200 nm length scale, for 3D imaging.
Simulation and modeling of nanostructures	• Models and simulations to interpret and quantify experimental results; • State-of-the-art theoretical and simulation methodologies to guide experiments aimed at the measurement and characterization of size, shape, and composition of nanostructures; • Extension of modeling of electron trajectories to three-dimensional nanostructures of arbitrary shape; • Models and simulations of the reliability of nanodevices; and • Models and simulations of the routes to self-assembly of nanostructures.

Enabling nanotechnology from discovery to manufacture	
Technical Area	**Outputs**
Measurements and standards in support of ultimate CMOS	• New methods to measure critical dimensions in semiconductors with sub-nanometer resolution; • Method for measuring the electrical and thermal properties of, and identifying defects in, complex semiconductor interfaces; • Method for measuring the mechanical properties of dielectric films in semiconductors; • Methods to measure the nature and rates of the complex physico-chemical processes used in CMOS semiconductor fabrication; • A new state-of-the-art reference dimensional metrology scanning electron microscope (SEM) and accurate metrology methods for full-size semiconductor wafers and masks; and • Advanced models necessary for optical metrology at the "32-nanometer node" of semiconductor manufacturing.

Performance Measures: Outcomes

At the proposed funding level, this initiative will foster the following outcomes:

- Enhanced competitiveness for U.S. industry in the world for the manufacturers of products that incorporate nanotechnology;
- Speedier private sector commercialization of new products and innovations that integrate nanotechnology and nanomanufacturing, for example, high strength, high toughness materials for greater auto fuel efficiency and personal protection;
- More compact, powerful, and innovative products resulting from nanotechnology-enhanced electronic chips that are smaller, faster and more efficient; and
- Increased yield, productivity, and reliability in the manufacturing of nanostructures and devices for the electronics, sensor, information storage, and communications industries.

Without development of the measurement, modeling, and simulation capabilities described in this initiative, U.S. industry will not have available the full range of tools and atomic-level understanding necessary to design, characterize, and control three dimensional nanostructures in their fabrication processes, and minimize device failure due to mechanical properties and defects. Without advanced measurement and modeling capabilities at the nanoscale, industry will need to rely more on trial and error for discovery and development, which increases the time and cost to market and reduces competitiveness.

2. **Enabling Innovation through Quantum Science (+13 Permanent Positions, +10 FTE, +$4,000,000, including $500,000 transfer to the Working Capital Fund)**

"Quantum information is a radical departure in information technology, more fundamentally different from current technology than the digital computer is from the abacus." William D. Phillips, NIST 1997 Nobel Laureate in Physics

By exploring and harnessing the "special" properties of the quantum realm, NIST will open the gateway to a new and powerful technological frontier. If successful, NIST's work will pave the way to:

- Greater computing power than what is available with electronic computers,
- Secure communications for national security, financial, and market transactions, and
- Enable advanced measurement capabilities that exceed classical techniques.

Problem Magnitude and NIST Role:

"The Administration favors Federal R&D investments that... enable potentially high payoff activities that require a Federal presence to attain long-term national goals, including national security...Priority will be given to research...that aim[s] to close significant gaps in the fundamental physical understanding of phenomena that promise significant new technologies with broad societal impact. ...quantum condensates are examples of novel atomic and molecular-level systems that are only partially understood, and where coherent control holds great potential." FY 2007 Administration Research and Development Budget Priorities.

Since the early 20th century we have known that the atomic, or quantum, realm works under vastly different rules than the world of our everyday experience. The ability to understand and exploit many aspects of the quantum realm led to many of the technological advances that defined the last century. Yet the quantum realm holds still more surprises, and more possibilities. Unique quantum properties that have no counterparts in our everyday world have been the most difficult aspects of the quantum world to understand. But understanding and mastering these quantum properties hold great promise for new technologies. It has only been in recent years that we have developed the capacity to create and control quantum properties in the laboratory, and it is this capacity that is opening a door to new possibilities with broad societal impact. Many of the greatest physicists believe that exploitation of these non-intuitive properties of nature will transform the technology of the 21st century, just as electronics transformed the technology of the 20th. However, because there are so many unanswered questions, there must be "a Federal presence to attain long-term national goals."

Researchers at NIST have been and are in the forefront of demonstrating that unique quantum properties can be created and controlled in the laboratory. These advances, which have led to three Nobel Prizes for NIST scientists, have fostered the hope of fantastic new capabilities,

such as quantum computing with superior power compared to today's classical computers and quantum communication with unbreakable security. NIST scientists were the first to demonstrate a quantum logic operation with quantum "bit", or "qubit", and among the first to demonstrate the principle of quantum communication. These early advances prompted NIST to begin a focused program in Quantum Information Science. That program is now the largest internal quantum research program in the Federal government and one of the most successful programs in the world. Now NIST scientists are hoping to push still further ahead. The ultimate goal for the NIST program is to parlay early proof-of-principle demonstrations into working components from which integrated quantum systems will ultimately be built. That this can be done is by no means certain.

The research and development steps required to realize a quantum computer can be described in analogy with those of the familiar desktop computer based on classical microelectronic circuits. The desktop computer is an integrated system built from several distinct components including a central processing unit (CPU) which functions as the brain of the computer, a temporary memory device for holding CPU instructions and data, a permanent storage device (hard drive) for holding data over the long term, input/output devices such as a keyboard, monitor, or internet connection for getting information into or out of the computer, and a communications bus for passing information between components.

NIST's previous initiatives in quantum information focused on demonstrating the most elementary function of a processing unit, a quantum logic operation on a quantum "bit", or "qubit". The classical desktop computer has a processing unit capable of processing billions of bits per second. Although a quantum computer will be very powerful while operating with far fewer logic "bits" than a classical computer, a great deal of effort is required to produce an integrated quantum processing unit with several hundred qubits. In the case of classical computing, the time between demonstration of a single logic "bit" and an integrated processor was more than two decades. Work on building a quantum processing unit with more than one qubit has been initiated with existing resources, but with the successful proof-of-principle demonstration of a few qubits, additional investment in this work to increase the rate of progress is warranted.

The realization of a quantum computer will also require the development of other components. Among these is a temporary memory capability, analogous to the random access memory (RAM) of the classical desktop computer. At present, qubits are lost relatively rapidly because of the extreme sensitivity of quantum "coherence" to external interactions. The ability to store qubits before or after a logic operation will enable more complex logic operations.

Also required for the realization of a quantum computer is some kind of communications bus that allows for the transfer of information, or qubits, between processor and memory or input/output devices. In a classical computer, this capability is achieved by the metal wires conducting electrical currents to the various devices. NIST scientists have already achieved a proof-of-principle demonstration of the quantum analogy of a communications bus through a process called "teleportation" of information. Now they must show that quantum information can be teleported reliably and quickly, and that these "quantum wires" can be incorporated into a working component.

The incorporation of input/output devices in a quantum computer will require the ability to convert qubits from one form to another. In a processor, a qubit may be an atom, ion, or solid-state system prepared in a "coherent" state. An output device will sometimes require conversion of the processor qubit into a "flying" qubit, i.e., a photon, the smallest unit of light. The analogy in the classical computer is the conversion of electrical signals in a computer to the optical signals that flow through the optical fibers of the internet. A robust, reliable conversion process requires further research.

All of the above capabilities, including those in quantum communications, require further development of optical materials for use in the blue and ultraviolet region of the spectrum. These materials will enable the diode lasers, modulators, and single photon sources and detectors that will be used to create, manipulate, and read quantum logic operations and transmit quantum information in a practical integrated quantum system. Most of these devices do not exist at all or do not exist with the required performance characteristics.

Proposed NIST Technical Program:

In moving closer to the realization of manipulating quantum phenomena in the quest for developing new measurement techniques and technologies, NIST is proposing to further expand its quantum science program in FY 2008. Initiative funding in FY 2008 is being requested to develop more quantum computer and communication components, to begin developing the basis for more advanced quantum applications, and to advance quantum measurement capabilities. NIST will:

- Begin development of quantum wires to be used for connecting various quantum components;
- Begin development of a quantum memory, to enable more complex quantum logic operations;
- Begin development of methods for inter-converting material qubits (atoms, ions, or solid-state systems) to photon qubits;
- Develop an all-optical clock as a next step in precision time and frequency measurement;
- Develop methods for higher rate production and counting of single electrons; and
- Continue to exploit quantum coherence and quantum entanglement for measurement capabilities exceeding classical limitations in sensitivity, accuracy, and speed.

The funding requested in FY 2008 will enable NIST to build on and exploit the research accomplishments supported by initiative funding in the previous three years. For instance, NIST in FY 2005 and FY 2006 demonstrated simple quantum logic operations, the basis for a quantum processor, using neutral atoms and trapped ions. NIST also demonstrated single photon sources and detectors, the basis of quantum communication system. FY 2007 requested funding enabled NIST to develop quantum components and early applications of quantum information science, specifically the demonstration of a complete quantum communication system operating at speeds high enough for practical use. NIST will demonstrate a quantum logic clock capable of serving as an improved time and frequency standard for the next generation of the Global Positioning System and in tests of fundamental physical theories. Other FY 2007 efforts include 1) a quantum input/output device and expanded work on quantum logic operations, with the demonstration of quantum logic in a

superconducting solid-state system as an alternative to trapped ions and neutral atoms; 2) new quantum measurement capabilities for improved determination of fundamental units in mass, temperature, time, light, and electric current; and 3) establishment of a Joint Quantum Institute, leveraging the interdisciplinary capabilities of NIST with those of the National Security Agency and the university partner. All of the FY 2005, 2006, and 2007 activities will continue at existing or increased levels in FY 2008.

Performance Measures: Outputs

At the proposed funding level, NIST will generate the following outputs:

Enabling innovation through quantum science	
Technical Area	**Outputs**
Quantum components	• Quantum wires, including the demonstration of plasmonic communication pathways for single photon transmission; and • Demonstrate long storage time and stability for a quantum memory.
Basis for more advanced quantum devices	• Fabrication of an integrated ion quantum system containing a solid-state ultraviolet laser; • Advanced solid-state ultraviolet quantum lasers able to produce entangled photon pairs; • Fabrication of nano-mechanical resonator and demonstration of coupling to quantum system; • Single-photon detection at greater than 10 MHz with greater than 95percent detection efficiency (100 times faster than present); • Single-photon detection at 1 GHz with greater than 80 percent detection efficiency (100 times faster than present); • Advanced high-speed optical modulators; • Teleportation and conversion of quantum information from one type of quantum system to another; • Conversion of individual quantum systems into composite quantum systems; • Demonstration of the coupling of quantum systems with classical electromagnetic fields; and • Better understanding of wider range of quantum systems and the fundamental limits of quantum noise.
Quantum measurements	• New quantum-based measurement technologies will be produced including a quantum enhanced clock, improved frequency measurement, methods for manipulating single electrons, quantum-based temperature, high speed single photon sources, and quantum realization of mass.

Performance Measures: Outcomes

At the proposed funding level, NIST will generate the following outcomes:

- NIST will begin bridging the gap between fundamental quantum science and new technologies by developing some of the quantum components needed for realization of a quantum computer; and.
- NIST will develop quantum measurement techniques applicable to the Nation's most fundamental measurement needs.

Quantum Science Activity Matrix

Concept	FY 2005/2006	FY 2007	FY 2008	FY 2009	FY 2010
Quantum Logic Operations	Initial demonstration of quantum logic operations with 1-5 atom qubits	Demonstration of quantum logic operations with 5-10 atom qubits			Quantum logic operations with 10 or more atom/ion qubits
		Initial demonstration of quantum logic operations with 1-5 solid-state qubits		Quantum logic operations with 5-10 solid-state qubits	
Quantum Components	Demonstration of single photon sources and detectors				Improved higher-speed counting of single photons
		Demonstration of input/output devices		Improved input/output devices	
			Quantum wires		
			Quantum memory		
Early Applications of Quantum Science		Demonstration of quantum logic clock			
	Demonstration of quantum communications testbed	Secure, high-speed quantum communications		Improved high-speed quantum communications	

Concept	FY 2005/2006	FY 2007	FY 2008	FY 2009	FY 2010
Quantum Measurements		Demonstration of quantum mass and temperature	Application of quantum technologies to new measurement methodologies		
			Demonstration of higher rate of single electron counting/production	Application of single electron manipulation to nanosystems	
			Development of optical clock	Quantum enhanced clocks	
				Development of high-speed single photon source	Bridge gap between single photon sources and laser power
Basis for More Advanced Quantum Devices			Integrated optics for blue light		
			Conversion of material qubits to flying qubits		
				Coherent control and transformation of quantum information	Increased funding for FY 2009 activity
					Integrated ion traps and architectures for quantum computing

Note: Activities in the Joint Quantum Institute encompass many of the projects in this matrix.
The first appearance of an activity in a row represents initiation of that activity with new initiative funding.

3. **Measurements and Standards for the Climate Change Science Program (+20 Positions, +15 FTE, +$5,000,000, including $1,000,000 transfer to the WCF)**

"Investments in global climate change science...provide the basis for sound long-term climate policy decision-making..." FY 2008 Administration Research and Development Budget Priorities.

NIST has the opportunity to address critical gaps in climate change science that are limiting long-term climate policy decision-making by proposing to:

- Resolve discrepancies in satellite–based measurements of solar intensity, and
- Provide critical information about an atmospheric component believed to play a major role in global climate change.

Problem Magnitude and NIST Role:

"Agencies should continue to support the goals of the 2003 Strategic Plan for the U.S. Climate Change Science Program..." FY 2008 Administration Research and Development Budget Priorities.

The Nation's ability to respond to climate change depends on our ability to predict the course and causes of climate changes as early as possible. Our ability to predict climate changes rests on the accuracy of atmospheric measurements and on knowledge of basic properties of atmospheric constituents. The two types of data identified by the Climate Change Science Program (CCSP) as critical to improved modeling of climate change are the solar irradiance (the intensity of sunlight falling on the Earth) and the properties of aerosols (microscopic airborne particles or droplets).

Numerous climate monitoring systems in space, in the air, and on the ground are documenting the current state of Earth's atmosphere. These measurements provide essential information for predictive modeling of future climate changes. If the investment in climate measurements is to pay off, these measurements must be made with sufficient accuracy and precision. The measurement instrumentation, at a minimum, must be calibrated in a way that allows comparison of results across different measurement platforms as well as over time as additional measurements are made. The 2003 Strategic Plan for the U.S. CCSP emphasizes this priority by directly citing NIST's role.

"Efforts in the last decade to use current research and operational data sets in global climate change research have provided a critical set of lessons learned. ... Instrument calibration, characterization, and stability become paramount considerations. Instruments must be tied to national and international standards such as those provided by the National Institute of Standards and Technology (NIST)." p. 132.

One of the lessons learned, the need for greater attention to calibration of instruments, is illustrated in Figure 1. Since 1980, seven satellite-based instruments have monitored the solar irradiance for periods of a year or more. Despite the billions of dollars invested in these satellite programs, they have not provided a definitive picture of the true solar irradiance. The measurement results from the different instruments span a range of values that is an order of magnitude greater than the measurement accuracy required by the global climate change community. The desired accuracy is indicated by the vertical bar near the bottom of the graph. A satisfactory return on the heavy investment in these satellite systems will be obtained only if instrument calibration is given a higher priority. In the words of the *2003 Strategic Plan for the U.S. CCSP*:

"Rigorous pre-launch instrument characterization and calibration, including radiance confirmation, against an international radiance scale provided by a national metrology institute, should be ensured."

Under this initiative, NIST will help develop that international scale and will ensure the highest quality calibrations possible for future satellite-based measurements of the solar irradiance. For a small fraction of the cost of building and operating a satellite platform, this effort will prevent future calibration-related discrepancies like those seen in Figure 1.

A second critical gap in climate change research is the impact of aerosols on global warming. As indicated by Figure 2, aerosols are believed to play a major role in climate change, perhaps as large as the role played by greenhouse gases. However, we know much less about aerosols than about the major greenhouse gases. For example, almost nothing is known about the magnitude of indirect effect of aerosols, but it could be as large as the effect of carbon-dioxide. In another example, not only is the magnitude of the effect of mineral dust unknown, but also unknown is whether mineral dust would tend to warm or to cool the atmosphere.

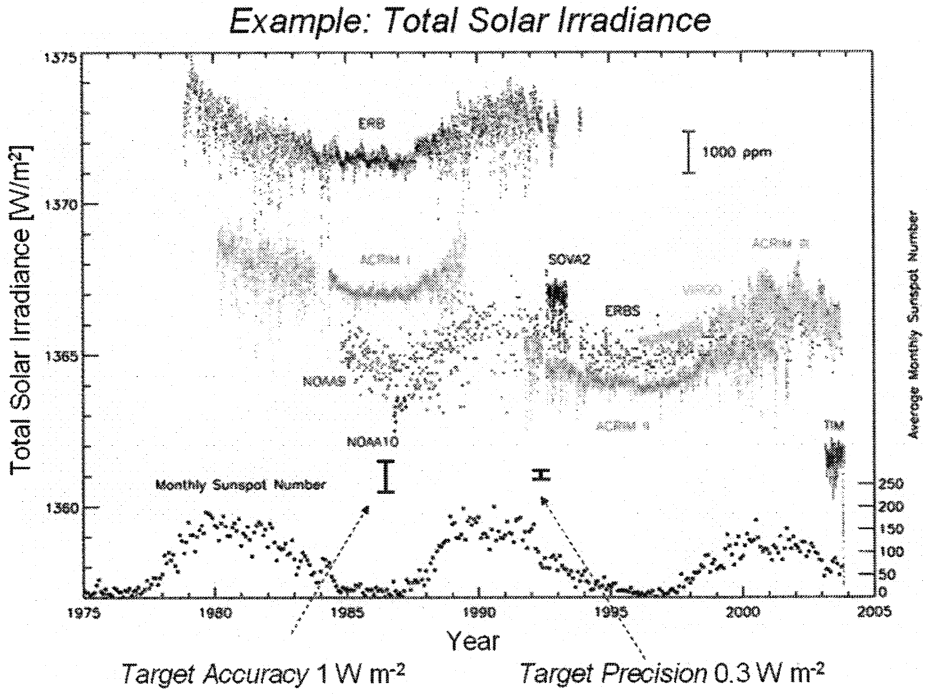


Figure 1. *The total solar irradiance during the period 1979-2004 as measured by 10 different satellite-based instruments. Also shown is the sunspot activity, which is correlated with a cyclical change in solar output. The two error bars in the bottom center of the graph indicate the needed accuracy and precision. Given the wide range of values obtained by individual instruments and the group as a whole, it is clear that neither of these has yet been achieved.*

Part of the reason we know so little about aerosols is that aerosols span a much wider range of properties than a given greenhouse gas. Aerosols are small particles, naturally-occurring or man-made, that are found in the atmosphere. Several major categories are given in Figure 2. Aerosols consist of complex aggregations of a number of different types of molecules, and can span four or more orders of magnitude in size. Because of their varied composition, aerosols also span a wide range of optical and chemical properties. For example, sulfate aerosols reflect solar radiation and generally cool the atmosphere, while black carbon-based aerosols absorb solar radiation and generally warm the atmosphere.

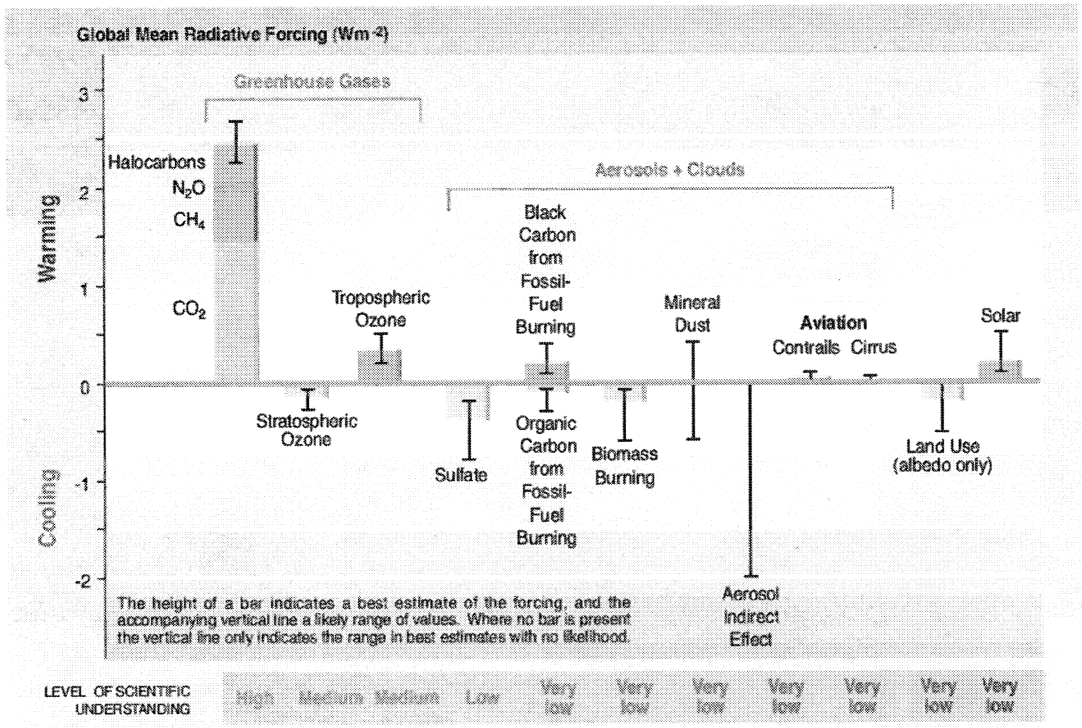


Figure 2. *Schematic comparing several factors influencing the global radiation budget. The length of each bar represents the best estimate of the change in Earth's radiation budget due to the various factors since 1750. The length of the vertical lines indicates uncertainty in the magnitude of the effect. Two principal categories of factors are the greenhouse gases and the combination of aerosols and clouds. Scientific understanding of aerosols is very low, as shown on the horizontal axis. Source: Climate Change 2001: Synthesis Report. A Contribution of Working Groups I, II, and III to the Third Assessment Report of the Intergovernmental Panel on Climate Change, R. T. Watson and the Core Writing Team, eds., Cambridge University Press, Cambridge, UK and New York, NY, USA. March 2002.*

<u>One of the biggest challenges in predicting climate change is the lack of detailed data for the wide range of aerosols that need to be included in numerical modeling</u>. The reflection or absorption of solar radiation, cloud formation through ice and water droplet condensation, and catalysis of important chemical reactions such as those that lead to the destruction of stratospheric ozone cannot be correctly accounted for

without a better understanding of basic properties. The 2003 Strategic Plan for the U.S. CCSP emphasizes this need in the first of five priority questions about atmospheric composition.

"What are the climate-relevant chemical, microphysical, and optical properties...of human-caused and naturally-occurring aerosols?"

Under this initiative, NIST will fill critical gaps in our understanding of climate-relevant aerosols. High-quality data on chemical, microphysical, and optical properties will be obtained by laboratory measurements or by computer calculation where measurements are too costly to perform. This data will show how aerosols absorb, reflect, or scatter direct sunlight or light reflected from the Earth. It will show how aerosols facilitate complex chemistry in the atmosphere, destroying or creating other important gases. The data will also help explain how aerosols are created, destroyed, or transported through the atmosphere to create the observed distributions, and will aid in the interpretation of atmospheric measurements.

In the end, basic information about the properties of aerosols and more accurate measurements of solar irradiance will both improve the accuracy of climate modeling. Accurate climate modeling will enable more accurate predictions of future climate changes and, ultimately, a better foundation for policy decisions.

Proposed NIST Technical Program:

At the proposed funding level:

- NIST, in coordination with NOAA, will develop a comprehensive pre-launch satellite system calibration program to ensure the highest possible accuracy for climate and atmospheric measurements. NIST will provide calibrations traceable to international standards so that measurements made from different satellites and at different points in time can be reliably integrated into an accurate picture of Earth's climate. Elements of this program will produce:
  - New techniques for ground-based calibration of satellite measurement systems using advanced radiometric standards:
    - that more realistically simulate the actual view seen in orbit;
    - that provide the higher accuracy required by climate research, and
    - that can be transported to other agency and vendor development sites.
- New instrument design strategies to optimize accuracy and stability of satellite-based measurement systems.

- Measurement quality assurance programs for satellite instrument development teams including:
  - best practices training of instrument design and construction teams;
  - on-site verification that instrument design standards and calibration standards are met;
  - trouble-shooting for calibration problems that arise during design and construction; and
  - inter-comparisons among international instrument calibration laboratories to ensure all satellite-based instruments, including those of international partners, are linked to the same standard.
- NIST, working with other agencies, will fill critical gaps in aerosol data required for accurate modeling of climate change. This effort will produce:
  - Techniques to generate aerosols in the laboratory so that required aerosol studies can be conducted both at NIST and elsewhere;
  - Metrology for characterizing the wide range of optical and physical properties of aerosols;
  - Computational techniques for calculating aerosol properties that cannot be measured in the laboratory; and
  - A database of critically-evaluated aerosol properties obtained from measurements at NIST and from other laboratories.

Performance Measures: Outputs

At the proposed funding level, NIST will generate the following outputs:

Measurements and standards for the climate change science program	
Technical Area	**Outputs**
Standards for pre-launch satellite system calibration (FY 2008-ongoing)	• Hyper-spectral image projection technique will provide the capability for calibrating satellite sensors using sources matching spatial, spectral, and temporal profiles seen on-orbit; • Advanced accuracy, portable calibration sources based on light-emitting diodes; • New instrument design strategies resulting from collaboration with satellite development teams; • Curriculum and workshops on best practices for instrument design and construction teams; • Verification and documentation of implementation of critical calibration design criteria throughout instrument development process; • Technical support for instrument development teams on problems related to calibration; and • Inter-comparison round-robin among international instrument calibration laboratories to ensure adherence to a common standard.

Measurements and standards for the climate change science program	
Technical Area	**Outputs**
Reference metrology and standards for critical atmospheric constituents (FY 2008-ongoing)	• Laboratory production methods for wide range of aerosols of interest to climate change modeling; • Metrology methods for characterizing optical and physical properties of aerosols; and • Computational methods for determining optical and physical properties of aerosols that cannot be measured.

Performance Measures: Outcomes

At the proposed funding level, NIST will fill two critical gaps in data needed for accurate climate modeling:

- NIST will enable the accurate determination of the solar irradiance as a function of time; and
- NIST will provide basic data on the behavior of aerosols that have the greatest impact on the global climate.

These data will improve the accuracy of climate change predictions, providing policymakers with accurate information about the advantages and consequences of various policy options.

4. Disaster Resilient Structures and Communities (+5 Positions, +4 FTE, +$4,000,000)

In the wake of the Hurricane Katrina disaster in the summer of 2005, President George W. Bush stood in Jackson Square in New Orleans and called upon the Nation to be "better prepared for any challenge of nature or act of evil men that could threaten our people."

Problem Magnitude and NIST Role:

Despite significant progress in disaster-related science and technology, natural and technological disasters in the United States are responsible for an estimated $52 billion in average annual costs in terms of lives lost, disruption of commerce and financial networks, properties destroyed, and the cost of mobilizing emergency response personnel and equipment. Natural hazards–including extreme winds (hurricanes, tornadoes, windstorms) and storm surge, wildland fires, earthquakes, and tsunamis–are a continuing and significant threat to U.S. communities. Activities of man that are accidental, criminal, or terrorist can lead to disastrous community losses as well. A single event such as a major earthquake or hurricane could potentially cause $80 billion to $200 billion in economic losses in the affected areas.

The disaster resilience of our structures and communities today is determined in large measure by the building codes, standards, and practices used when they were built. With few exceptions, these legacy codes, standards, and practices which have evolved over several decades are prescriptive, oversimplified, and inconsistent with respect to risk. Codes and standards are developed through a voluntary consensus process by private sector organizations that lack the resources to carry out the research required to develop the technical basis for improved codes and standards.

As costs continue to rise, there is increasing recognition of the need to move from response and recovery to proactively identifying hazards that pose threats and taking action to reduce the potential impacts. Whether hazards become disasters depends upon the disaster resilience of our structures and communities. This, in turn, depends upon the capacity to prepare for and mitigate the impacts of hazards, preventing them from becoming disasters. This initiative is focused directly on selected solutions demanded by five of six Grand Challenges identified by the President's National Science and Technology Council in June 2005 for advancing science and technology to enhance disaster resilience and thus improve the Nation's ability to face disasters. They are:

- Provide hazard and disaster information where and when it is needed;
- Understand the natural processes that produce hazards;
- Develop hazard mitigation strategies and technologies;
- Assess disaster resilience using standard methods; and
- Promote risk-wise behavior.

NIST and NOAA have coordinated their programs to work together to provide (1) advanced hazard assessment, warning guidance, forecasting tools, and mitigation strategies; (2) models, metrics, and knowledge to modernize building codes, standards and practices; and (3) optimized delivery of information to enable Disaster Resilient Communities. In addition, NOAA will provide real-world observations and scalable hazard model output data at the community level, and NIST will provide expertise on building and fire resilience based on the NOAA hazard models.

This program proposes to develop the scientific basis required to enable technology innovations, improve prediction capabilities, and improve codes and standards for cost effectively reducing loss of life and property damage due to natural and man-made hazards. The fundamental new idea underpinning this initiative is that disaster resilience can be enhanced by developing a robust capability to *predict* the effects of hazards on the *performance* of complex structural systems and at scale in the community. This will be achieved by developing validated *data* to characterize the hazard environment, validated physics-based *models* to predict performance, *metrics* for measuring performance, acceptance *criteria* for differing levels of performance objectives, and *mitigation* strategies based on evaluated performance.

The role of NIST is well-established in these areas:

- NIST is authorized to both lead and conduct performance-based seismic engineering research under the National Earthquake Hazards Reduction Program (NEHRP) Reauthorization Act of 2004.
- NIST is authorized to conduct wind research under the National Windstorm Impact Reduction Act of 2004.
- NIST is authorized to conduct basic and applied research that enables protection of life and property from fire under the Federal Fire Prevention and Control Act of 1974.
- NIST houses the national Building and Fire Research Laboratory whose technologies are used by standards, codes, and building and fire engineering professionals around the world.

The scope of the $2.0 million FY 2007 initiative includes work on the safety of structures during extreme winds, fires at the wildland-urban interface, and strong-motion earthquakes, with the intent of ramping up the effort with the FY 2008 initiative.[4] The combined funding supports a sustained critical mass effort with potential for significant impact in these areas.

For FY 2008, the scope of the $4.0 million initiative includes work on the disaster resilience of structures and *communities* during extreme winds and *storm surge*, fires at the wildland-urban interface, and strong-motion earthquakes. It also includes work on multi-hazard failure analysis, *decision-support tools for economic assessment of multi-hazard mitigation solutions,* and *standard methods to predict losses and evaluate disaster resilience at the community and regional scales.* Further, *the FY 2008 initiative is based on a joint program plan with NOAA that includes collaborative work in all hazard areas, with the exception of complementary work in earthquakes (NIST) and tsunamis (NOAA).* (Note: The items in italics above are new starts for FY 2008.)

Proposed NIST Technical Program:

New program starts in FY 2008 (tightly coupled to FY 2007 initiative):
Standard Methods to Predict Losses and Evaluate Disaster Resilience at the Community and Regional Scales. NIST–in partnership with NOAA, FEMA and other entities, notably insurance industry organizations–will develop an enhanced science base and standard methods that can be used to improve existing models and tools used by public or private organizations to predict losses and evaluate disaster resilience at the community and regional scales for fires at the wildland-urban interface and hurricane-induced wind and surge simulations.

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[4] *The industry-developed R&D roadmap to close the research-to-practice gap and accelerate the use of new earthquake risk mitigation technologies recommended a sustained budget of $6.5 million per year. Congress authorized $4 million in FY 2007 and FY 2008 under the National Windstorm Impact Reduction Act of 2004 (P.L. 108-360). Congress also authorized $12.1 million in FY 2007 and $13.31 million in FY 2008 under the National Earthquake Hazards Reduction Program Reauthorization Act of 2004 (P.L. 108-360). A summary budget table itemized by technical area is provided at the end of this initiative justification.*

Validated "Computational Wind Tunnel" for Predicting Hurricane Wind Effects on Structures. The resulting "computational wind tunnel" has the potential to revolutionize structural design for extreme wind conditions by providing a computational method for testing structural designs—minimizing the need for physical wind tunnel testing and allowing for faster testing over a wider range of conditions and lower costs.

Decision Support Tools for Economic Assessment of Multi-Hazard Solutions. NIST will develop decision support tools for economic assessment of multi-hazard mitigation solutions to help building designers, owners, and operators select the optimal mix of disaster protection strategies and efficient level of investment in each strategy to achieve a target level of protection at minimum life-cycle cost.

Risk-Based Storm Surge Maps for the Design of Structures in Coastal Regions and an Improved Saffir-Simpson Hurricane Intensity Classification Scale. NIST will work in partnership with NOAA to develop risk-based storm-surge maps for the design of structures and an enhanced Saffir-Simpson hurricane intensity classification scale. This FY 2008 new start will build on earlier work associated with Hurricanes Katrina and Rita which will be extended to cover the entire U.S. Gulf and Atlantic Coast regions. The enhanced Saffir-Simpson hurricane intensity scale will consider risk-consistent combinations of wind speed and storm-surge height.[5]

Programs in FY 2007 President's Budget to be Enhanced in FY 2008:

Prediction of Fire Hazards at the Wildland-Urban Interface. The additional FY 2008 funds for the wildland-urban interface (WUI) fire program will be used to expand and initiate new efforts in two major areas: (1) creating and maintaining the database of structural and vegetative fuels unique to the wildland-urban interface with an initial focus on communities identified as high risk; and (2) extending and validating model-based tools for WUI fire behavior and smoke transport in close collaboration with NOAA and integrating the resulting model within NOAA's Fire Weather Forecast system. The NOAA-NIST Fire Decision Support Tool created with funding from the FY 2008 initiative will include the following information for tactical and strategic planning to improve community and fire fighter safety and reduce property losses:

- Predictions of fire behavior and changes in fire intensity based on fuel maps, topography, man-made features (*e.g.,* roads), and wind;
- Predictions of fire location relative to WUI communities and first responder access roads;
- Air quality and obscuration assessment of predicted smoke levels in WUI communities, over access roads, evacuation routes, and air corridors in the proximity of the fire; and
- Air quality assessment of predicted smoke levels in downwind communities.

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[5] *While Hurricane Katrina wind speeds were consistent with a Category 3 storm, the storm-surge heights exceeded Category 5 on the hurricane intensity scale.*

Earthquake Resistant Structures: Tools for Design, Construction, and Mitigation. The FY 2007 and FY 2008 areas of work are all separate but complementary and are based on separate recommendations found in the industry R&D roadmap developed by the Applied Technology Council (The Missing Piece: Improving Seismic Design and Construction Practices, ATC-57). ATC-57 had its genesis in the 2001-2005 NEHRP Strategic Plan. ATC-57 recommends that NIST focus on two broad programmatic areas in support of NEHRP: systematic support for seismic building code development, and improvement of seismic design and construction productivity. In the first program area, two areas of research are suggested: providing technical support for code development and developing the technical basis for performance-based seismic engineering (PBSE). PBSE research has been mandated by Congress in P.L. 108-360. In the second program area, three areas of research are suggested: developing national design guidelines and manuals; disseminating evaluated technologies to practitioners in clear and succinct form; and developing tools to improve productivity in the design process. The roadmap identified component projects within these program areas with a recommended sustained budget of $6.5 million/year. NIST will implement the highest priority projects in the roadmap consistent with appropriations.

Performance Measures: Outputs

At the proposed funding level, NIST will generate the following outputs:

Disaster resilient structures and communities	
Technical Area	**Outputs**
Understanding hazards to the built environment	Hurricane-induced extreme winds and storm surge-understanding the hazards • Improved Risk-based Storm Surge maps of all geographic station/basins along the U.S. Atlantic and Gulf coasts developed from validated/improved methodologies and software tools for storm surge simulation in collaboration with NOAA. These maps are essential for designing and developing standards for coastal structures and lifeline systems to withstand storm surges along the Atlantic and Gulf regions. • Improve and validate hurricane simulations for prediction of path, size, speed, and intensity by comparing best models with data from historical records. • Improved Warning and Emergency Evacuations-evaluate both wind and storm surge effects that are needed to enhance the Saffir-Simpson Hurricane Scale.

Disaster resilient structures and communities	
Technical Area	**Outputs**
Understanding hazards to the built environment (continued)	<u>Fires at the wildland-urban interface (WUI)-understanding the hazards</u> • Database of fuels (vegetation and structures) in WUI communities, beginning with communities identified at high risk from wildfires. Work in 2008 will include road and terrain features. • Develop methodologies for long-term maintenance and assessment of database, as well as new techniques for acquiring real time data during a fire by NIST's WUI rapid response team. • Database of experimental results for validation and calibration of model collected from controlled laboratory and field experiments, conducted by NIST, that extend the existing database for structural and vegetative WUI fuels. Includes collaboration with State Fire Marshall's and USDA Forest Service's efforts to establish WUI building standards and safety guidelines. • Stand-alone fire behavior and smoke transport model-based tools that are validated in a stepwise manner and capable of predicting the behavior and resulting smoke movement from fires spreading in WUI communities and adjacent wildlands. These tools have capabilities that range from operational to strategic.
Predictive technologies and mitigation strategies to enhance disaster resilience	<u>Advanced computational tools for determining realistic wind loads in the built environment</u> • Develop "computational wind tunnel" as an alternative to wind tunnel testing for structural design, beginning with the documented evaluation of current computational options, in cooperation with NOAA's National Weather Research program, standards associations for wind engineering, leading university programs, and industrial and commercial computational fluids dynamics software developers. <u>Fires at the wildland-urban interface – predicting and mitigating the hazards</u> • An integrated NOAA/NIST Fire Decision-Support tool. NOAA forecasts of fire weather will now provide predictions of fire behavior and smoke movement for use in tactical and strategic planning resulting in improved community and fire fighter safety and reduced property losses. • A Roadmap leading to the coupled NOAA/NIST operational fire weather / fire behavior prediction tool, incorporating NOAA's atmospheric simulations for background wind (input to fire model) and NIST's fire behavior model for fire location and heat and mass flux (input to atmospheric model) will be developed in FY 2008.

Disaster resilient structures and communities	
Technical Area	**Outputs**
Predictive technologies and mitigation strategies to enhance disaster resilience (continued)	<u>Seismic practice and code development for built structures to minimize risk from earthquakes.</u> • Improve procedures to evaluate performance of structure as a whole and interactions between components, rather than the current practice of piecemeal specifications and testing. Better data will be obtained from extensive analytical modeling and field observations during actual earthquakes. Translating these procedures into formats usable in national model building codes will result in more resilient structures at lower cost. • Publish Technical Brief: Tilt-Up Construction Details. The connections of pre-cast tilt-up wall and floor/roof panels to their underlying structural supports have been shown to fail in earthquakes. A catalog will be developed of connections that are expected to perform well in earthquakes. • Publish Technical Brief: Shotcrete Quality Control and Assurance (QC/QA). Shotcrete is often used to strengthen existing concrete or masonry walls in seismic retrofit projects. Robust field QC/QA measures will be developed to assure that shotcreting performs properly. • Publish Technical Brief: Earthquake Lessons Learned. Valuable field observations from damaging earthquakes will be documented. These would address significant technical topics not considered in post-earthquake investigation reports. <u>Tools and scientific basis for multi-hazard failure analysis and mitigation of complex structural systems*</u> • Methodology proposed for determining the residual reserve capacity of a structural system at any point during the failure sequence. • Methodology proposed for assessing alternative methods for attaining the performance design objective of full building burnout without partial collapse. **Structural failure of complex systems can result from a sequential cascade of failure events.*

Disaster resilience structures and communities	
Technical Area	**Outputs**
Standard methods to assess disaster resilience of the built environment	<u>Decision support tools for economic assessment of multi-hazard mitigation solutions to help building designers, owners, and operators</u> • Produce economic case study that uses the methodology to evaluate strategies for protecting against a selected hazard to the built environment. • Draft report on methodology (e.g., life-cycle costs and net present value) for measuring economic performance of mitigation strategies to help stakeholders select appropriate protection measures for four types of hazards to the built environment (i.e., earthquakes, storm surge, wildland-urban interface fires, and extreme wind events). <u>Predicting losses and evaluating disaster resilience at the community or regional scale</u> • Conduct laboratory and field measurement to provide scientifically based data for use in loss estimation models (*e.g.*, probability distribution of damage of various building components such as roofing, door, window, walls, siding components and other systems under various wind loads.) • Develop fragility relationships that are capable of predicting the level of damage to buildings, bridges, geotechnical structures, towers, masts, pipelines, roads and various other components of a functioning infrastructure system. • Identify potential community costs (*e.g.*, medical expenses, property losses, foregone business income) and corresponding stakeholders (*e.g.*, residents, businesses, insurance companies) impacted by natural and man-made hazards.

Performance Measures: Outcomes

At the proposed funding level, NIST will generate the following outcomes:

- There will be a reduction of risk from hurricanes and windstorms, fires at the wildland-urban interface, and earthquakes;
- The science-based tools will enable more robust hazard mitigation assessments, better resource allocation decisions, and guidance to communities for response to large-scale fires at the wildland-urban interface;
- The seismic, wind, and fire provisions for model building codes will be improved in both the short- and long-term; and
- Technical resources such as guidelines, manuals, and evaluation of mitigation technologies will enhance structural engineering practice.

A 2005 National Institute of Building Sciences study found that a dollar spent on mitigation saves society an average of $4, with positive benefit-cost ratios for all hazard types studied. Mitigation is sufficiently cost effective to warrant Federal funding on an ongoing basis both before disasters and during post-disaster recovery. Without this initiative, the data and predictive tools will not be available to identify the communities at greatest risk and to prioritize the most effective steps that can be taken to mitigate the impact of disasters. To remain in response and recovery mode – rather than proactive strategic planning and risk management – increases the likelihood of significant loss of life, property, and infrastructure due to accumulated annual events, as well as the potential for another major $80-200 billion loss due to a single severe event such as an earthquake or Katrina-scale hurricane.

Disaster Resilient Structures and Communities Summary Budget Table:

Technical Area	Budget (Dollar amounts in thousands)		
	FY 2007	FY 2008	Total
Extreme Winds			
Database Assisted Design	$300		$300
Computational Fluid Dynamics		$300	300
Storm Surge Maps		300	300
Fires at Wildland-Urban Interface			
Database of Unique WUI Fuels	350	680	1,030
Outdoor-scale Predictive Model	250	720	970
Earthquake-Resistant Structures			
Code Development Technical Support	225	210	435
Performance-Based Engineering	275	500	775
National Design Guidelines	225	350	575
Disseminating Evaluated Technologies	75	40	115
Design Productivity and Interoperability		400	400
Multi-Hazard Failure Analysis	300		300
Assessing Disaster Resilience			
Economic Decision Support Tools		150	150
Community-Scale Loss Estimation		350	350
Total	**2,000**	**4,000**	**6,000**

5. National Earthquake Hazards Reduction Program Initiative (+3 Positions, +2 FTE, +$3,250,000)

The Nation remains vulnerable to the damaging impacts of large earthquakes and other natural hazards. National Research Council (NRC) studies in 2003 and 2006 noted that there are several areas outside of California that have significant potential for earthquake-related damage and economic loss. Close to $8.6 trillion of structures and 75 million people are located in urban areas of moderate to high earthquake risk. These studies estimate that a single large earthquake in the U.S., like the one that struck Kobe, Japan, in 1995, will easily cause damage of $100 to $200 billion. This damage is on the order of the economic loss suffered in the 2001 terrorist attacks on the World Trade Center and Pentagon. Such an event would be sudden, unannounced and potentially cause great loss of life.

Problem Magnitude and NIST Role:

Development and Implementation of *Advanced Earthquake Risk Mitigation Technologies and Practices* ($2,250,000). This portion of the initiative fills a critical gap in the National Earthquake Hazards Reduction Program (NEHRP) process, which extends from basic research, to problem-focused research and development (R&D), and finally to technology implementation in the field. This gap has been termed the "research-to-implementation" gap. The problem-focused engineering R&D needed to transition basic engineering research that is performed largely by the academic community to a sufficient level of maturity for field implementation. Basic research, in effect, needs to be linked to field implementation via problem-focused engineering R&D. Within NEHRP, NIST is responsible for the problem-focused R&D. Research in this area will be performed in close collaboration with practitioners and will include activities to improve technical bases for current model building code provisions, development of design guidelines for practitioners (*e.g.*, guidelines for seismic design of port and harbor facilities), publishing of "tech briefs" for practitioners on focused engineering topics (*e.g.*, reinforced concrete seismic detailing), and problem-focused testing and analytical research that aims to advance fundamental research results to field usability (*e.g.*, application of emerging sensor technologies to improve structural performance).

Further Development of Techniques for *Evaluation and Rehabilitation of Existing Buildings* ($1,000,000). In the 35+ years since the 1971 San Fernando earthquake, the Nation has made tremendous strides through research, development, and technology transfer in new building design and construction. There has been much less development related to existing buildings. The largest losses in future earthquakes will come in the existing older building stock and other older infrastructure. A 2003 NRC study states "Perhaps the greatest overall risk in the United States is the severe earthquake damage (including collapse) to existing facilities and lifelines designed without consideration of earthquake effects." The lack of research on which to base analytical models and develop good reconstruction practice has forced the engineering community to adopt ultra-conservative approaches to seismic evaluation of existing buildings and rehabilitation designs for deficient buildings. In addition, older building materials and details are often of a poorer quality than those found in new construction. The combination of conservative evaluations and costly "fixes" for problems that are found drives building owners away from considering earthquake safety, so that many older buildings in seismically active regions have not been evaluated or strengthened. This leads to large portions of the existing building stock being potentially deadly in earthquakes. Research that combines basic and problem-focused R&D

efforts in this area will have immediate payoff. Research will focus on developing more accurate simplified analysis tools for older buildings and more cost-effective design tools and methods for highly vulnerable existing buildings. This component of the initiative will integrate NIST problem-focused R&D with basic research, and FEMA building code guideline development. A multi-pronged research, development, and implementation program will be developed and performed to address key problems found in analyzing and strengthening unreinforced masonry, non-ductile reinforced concrete, concrete precast tilt-up walls, and vulnerable residential systems. The inputs of state and local governments and other stakeholders will be obtained through multiple mechanisms (including workshops) in establishing priorities for the research and guidelines development effort and to ensure that the results can be used in standards, codes, and practices.

Performance Measures: Outputs

At the proposed funding level, NIST will generate the following outputs:

National Earthquake Hazards Reduction Program Initiative	
Technical Area	**Outputs**
Advanced Earthquake Risk Mitigation Technologies and Practices	• Identify implementation gaps between basic research results and design guidance and national model building code provisions; • Develop rational, cost-effective, consensus-based seismic design and analysis procedures for use in national model building codes; and • Design guidelines for the testing and design of major structural systems.
Evaluation and Rehabilitation of Existing Buildings	• Characterize fully the seismic capacities of typical older building structural components and systems, as they were built; and • Develop structural performance criteria, analytical models, and cost-effective rehabilitation techniques for existing buildings.

Performance Measures: Outcomes

At the proposed funding level, NIST will generate the following outcomes:

- Reduction in the national risk to life and property from earthquakes;
- Transition of the products of basic research related to earthquake effects on buildings and infrastructure into practical, science-based, cost-effective tools for evaluating new and existing buildings;
- The earthquake-related provisions of national model building codes will be improved in both the short and long-term; and
- Technical resources such as guidelines, manuals and mitigation technologies will enhance U.S. structural engineering practice and improve U.S. economic competitiveness in national and international construction markets.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: NIST laboratories
Subactivity: Laboratories and technical programs/National research facilities
Program Change: American Competitiveness Initiative (ACI)

Title	Grade	Number	Annual Salary	Total Salaries
Chemist	ZP V	2	109,886	219,772
Electrical engineer	ZP V	1	109,886	109,886
Physicist	ZP V	4	109,886	439,544
Chemist	ZP IV	5	93,418	467,090
Civil engineer	ZP IV	1	93,418	93,418
Computer scientist	ZP IV	2	93,418	186,836
Electrical engineer	ZP IV	2	93,418	186,836
Fire protection engineer	ZP IV	1	93,418	93,418
Mathematician	ZP IV	2	93,418	186,836
Mechanical engineer	ZP IV	1	93,418	93,418
Physicist	ZP IV	11	93,418	1,027,598
Research structural engineer	ZP IV	2	93,418	186,836
Chemist	ZP III	6	66,479	398,874
Computer scientist	ZP III	1	66,479	66,479
Electrical engineer	ZP III	1	66,479	66,479
Mechanical engineer	ZP III	1	66,479	66,479
Physicist	ZP III	6	66,479	398,874
Administrative/technical support	ZA II	4	45,843	183,372
Subtotal		56		4,752,299
Less lapse	25 %	(14)		(1,188,077)
Total full-time permanent (FTE)		42		3,564,222
2008 Pay Adjustment (3.0%)				106,927
Total				3,671,149

Personnel Data	
Full-Time Equivalent Employment:	
Full-time permanent	42
Authorized Positions:	
Full-time permanent	56

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: NIST laboratories
Subactivity: Laboratories and technical programs/National research facilities
Program Change: American Competitiveness Initiative (ACI)

Object Class		2008 Increase/ (Decrease) Obligations
11	Personnel compensation	
11.1	Full-time permanent	$3,671
11.9	Total personnel compensation	3,671
12.1	Civilian personnel benefits	986
21	Travel and transportation of persons	586
22	Transportation of things	145
23.3	Communications, utilities and miscellaneous charges	1,221
24	Printing and reproduction	71
25.1	Advisory and assistance services	0
25.2	Other services	661
25.3	Purchases of goods and services from Government accounts	2,294
25.5	Research and development contracts	4,745
25.7	Operation and maintenance of equipment	392
26	Supplies and materials	1,778
31	Equipment	1,150
32	Land and structures	0
41	Grants, subsidies and contributions	2,050
99	Direct obligations	19,750
	Transfer to NIST Working Capital Fund	2,500
	Total increase requested	22,250

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
SUMMARY OF RESOURCE REQUIREMENTS
(Dollar amounts in thousands)

	Positions	FTE	Budget Authority	Direct Obligations	Appro-priation
Continuing Resolution, 2007	1,784	1,854	$397,078	$402,976	$395,056
less: 2006 Unrequested projects			(11,888)	(11,888)	0
Adjustment to support level in 2007 President's Budget	166	124	74,584	74,584	71,946
less: Unobligated balance from prior year			0	(4,898)	0
less: Transfer from EAC	0	0	(2,772) 1/	(2,772) 1/	0
2008 Adjustments to base:					
plus: Restoration of 2007 deobligation offset	0	0	1,000	0	1,000
plus: Uncontrollable cost changes	0	0	23,295	23,295	23,295
less: Amount absorbed	0	0	(12,030)	(12,030)	(12,030)
less: Estimated recoveries, 2008	0	0	(1,000)	0	(1,000)
2008 Base Request	1,950	1,978	468,267	469,267	478,267
plus: 2008 Program changes	56	42	19,750	19,750	22,250
plus: Transfer from EAC			3,250 1/	3,250 1/	0
2008 Estimate	2,006	2,020	491,267	492,267	500,517

		2006 Actual		2007 Continuing Resolution		2008 Base		2008 Estimate		Increase/ (Decrease) Over 2008 Base	
Comparison by activity/subactivity:		Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount
NIST laboratories											
Laboratories and technical programs	Pos./Approp	1,674	$347,929	1,612	$347,117	1,720	$397,747	1,761	$413,997	41	$16,250
	FTE/Obl.	1,603	352,417	1,652	354,522	1,733	392,029	1,764	410,029	31	18,000
National research facilities	Pos./Approp	125	39,542	128	40,076	186	72,426	201	78,426	15	6,000
	FTE/Obl.	127	39,136	150	40,140	193	69,120	204	74,120	11	5,000
Subtotal, NIST laboratories	Pos./Approp	1,799	387,471	1,740	387,193	1,906	470,173	1,962	492,423	56	22,250
	FTE/Obl.	1,730	391,553	1,802	394,662	1,926	461,149	1,968	484,149	42	23,000
Baldrige national quality program	Pos./Approp	45	7,291	44	7,863	44	8,094	44	8,094	0	0
	FTE/Obl.	44	7,068	52	8,314	52	8,118	52	8,118	0	0
TOTALS	Pos./Approp	1,844	394,762	1,784	395,056	1,950	478,267	2,006	500,517	56	22,250
	FTE/Obl.	1,774	398,621	1,854	402,976	1,978	469,267	2,020	492,267	42	23,000

Comparison by activity/subactivity:	2006 Actual		2007 Continuing Resolution		2008 Base		2008 Estimate		Increase/ (Decrease) Over 2008 Base	
	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount
Adjustments for:										
Recoveries		(2,097)		(1,000)		(1,000)		(1,000)		0
Unobligated balance, start of year		(5,192)		(4,898)		0		0		0
Unobligated balance, end of year		4,898		0		0		0		0
Unobligated balance, expired account		4								
Budget Authority		396,234		397,078		468,267		491,267		23,000
Financing from transfers:										
Transfers to other accounts		1,300		750		10,000		12,500		2,500
Transfer from Election Assistance Commission		(2,772) [1/]		(2,772) [1/]		0		(3,250) [1/]		(3,250) [1/]
Appropriation		394,762		395,056		478,267		500,517		22,250

[1/] Actual and proposed transfers from Election Assistance Commission.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
ADJUSTMENTS TO BASE
(Dollar amounts in thousands)

	Perm. Pos.	FTE	Amount
Adjustments:			
Restoration of FY 2007 deobligation offset	...	...	$1,000
Financing:			
Recoveries of prior year deobligations	...	...	(1,000)
Other Changes:			
Annualization of 2007 Pay raise	...	...	1,094
2008 Pay increase and related costs	...	...	4,984
Change in compensable days	...	...	1,676
Personnel benefits:			
Civil Service Retirement System (CSRS)	...	...	(203)
Federal Employees' Retirement System (FERS)	...	...	324
Thrift Savings Plan (TSP)	...	...	3,958
Federal Insurance Contribution Act (FICA) - OASDI	...	...	258
Health insurance	...	...	830
Employees' Compensation Fund	...	...	(58)
Travel and transportation of persons:			
Mileage	...	...	3
Rental payments to GSA	...	...	(4)
Communications, utilities, and miscellaneous charges:			
Postage	...	...	15
Electricity rate increase	...	...	2,166
Natural gas rate increase	...	...	5,355
Other services:			
Working Capital Fund (Departmental Management)	...	...	37
Commerce Business Systems (CBS)	...	...	66
NARA storage costs	...	...	(15)
Supplies and materials:			
Scientific journal subscriptions	...	...	108

	Perm. Pos.	FTE	Amount
General pricing level adjustment:			
Transportation of things	...	...	25
Rental payments to others	...	...	32
Communications, utilities, and miscellaneous charges	...	...	72
Printing and reproduction	...	...	12
Other services	...	...	1,466
Supplies and materials	...	...	408
Equipment	...	...	686
Subtotal, Other changes	0	0	23,295
Total, Adjustments to base required	0	0	23,295
Amount absorbed	0	0	(12,030)
Total, Adjustments to base requested	0	0	11,265

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF ADJUSTMENTS TO BASE
(Dollar amounts in thousands)

	FTE	Amount
Adjustments:		
Restoration of FY 2007 deobligation offset	0	$1,000

In FY 2007, NIST's STRS budget authority was reduced by $1,000,000 based on an estimated level of prior year deobligations. This adjustment would restore the reduction in FY 2008.

Financing:		
Recoveries of prior year deobligations	0	(1,000)

NIST's FY 2008 STRS budget authority is reduced by the estimated level of prior year deobligations in FY 2008.

Other Changes:

Annualization of 2007 pay raise		0	1,094

A pay raise of 2.2 percent is assumed to be effective January 1, 2007.

Total cost in FY 2008 of 2007 pay raise	$4,376,000
Less amount requested in FY 2007	(3,282,000)
Less amount absorbed in FY 2007	0
Amount requested in 2008 to provide full-year cost of 2007 pay raise	1,094,000
Payment to Departmental Management Working Capital Fund	0
Total, FY 2007 pay raise increase in FY 2008	1,094,000

2008 Pay increase and related costs		0	4,984

A general pay raise of 3.0 percent is assumed to be effective January 1, 2008.

Total cost in FY 2008 of pay increase	$4,909,000
Less amount absorbed in FY 2008	0
Amount requested for FY 2008 pay increase	4,909,000
Payment to Departmental Management Working Capital Fund	75,000
Total adjustment for FY 2008 pay increase	4,984,000

Change in compensable days		0	1,676

The increased cost of two more compensable days in FY 2008 compared to FY 2007 is calculated by dividing the FY 2007 estimated personnel compensation ($181,172,000) and applicable benefits ($36,763,000) by 260 compensable days. The cost increase of two more compensable days is $1,676,423.

Personnel benefits	0	5,109

Civil Service Retirement System (CSRS)	($203)
Federal Employees' Retirement System (FERS)	324
Thrift Savings Plan (TSP)	3,958
Federal Insurance Contribution Act (FICA) - OASDI	258
Health Insurance	830
Employees Compensation Fund	(58)

Civil Service Retirement System (-$203,000) – The number of employees covered by the Civil Service Retirement System (CSRS) continues to drop as positions become vacant and are filled by employees who are covered by the Federal Employees' Retirement System (FERS). The estimated percentage of payroll for employees covered by CSRS will decrease from 20.2 percent in FY 2007 to 18.6 percent in FY 2008. The contribution rate will remain at 7.0 percent in FY 2008.

Payroll subject to retirement systems ($180,809,656)	
Cost of CSRS contributions in FY 2008 ($180,809,656 x .186 x .07)	$2,354,142
Cost of CSRS contributions in FY 2007 ($180,809,656 x .202 x .07)	2,556,649
Total adjustment to base	(202,507)

Federal Employees' Retirement System ($324,000) – The number of employees covered by FERS continues to rise as employees covered by CSRS leave and are replaced by employees covered by FERS. The estimated percentage of payroll for employees covered by FERS will increase from 79.8 percent in FY 2007 to 81.4 percent in FY 2008. The contribution rate will remain at 11.2 percent in FY 2008.

Payroll subject to retirement systems ($180,809,656)	
Basic benefit cost in FY 2008 ($180,809,656 x .814 x .112)	$16,484,055
Basic benefit cost in FY 2007 ($180,809,656 x .798 x .112)	16,160,044
Total adjustment to base	324,011

Thrift Savings Plan ($3,958,000) – The cost of agency contributions to the Thrift Savings Plan will also rise as FERS participation increases. The contribution rate has increased from 2.00 percent to 4.65 percent.

Thrift plan cost in FY 2008 ($180,809,656 x .814 x .0465)	$6,843,826
Thrift plan cost in FY 2007 ($180,809,656 x .798 x .0200)	2,885,722
Total adjustment to base	3,958,104

Federal Insurance Contributions Act (FICA) - OASDI ($258,000) – As the percentage of payroll covered by FERS rises, the cost of OASDI contributions will increase. In addition, the maximum salary subject to OASDI tax will increase from $96,150 in FY 2007 to $102,300 in FY 2008. The OASDI tax rate will remain 6.2 percent in FY 2008.

FERS payroll subject to FICA tax in 2008 ($180,809,656 x .814 x .902 x .062)	$8,230,842
FERS payroll subject to FICA tax in 2007 ($180,809,656 x .798 x .892 x .062)	7,979,599
Increase (FY 2007-FY 2008)	251,243
OTP payroll subject to FICA tax in FY 2008 ($4,993,344 x .814 x .902 x .062)	227,308
OTP payroll subject to FICA tax in FY 2007 ($4,993,344 x .798 x .892 x .062)	220,369
Increase (FY 2007-FY 2008)	6,939
Total adjustment to base	258,182

Health insurance ($830,000) – Effective January 2006, NIST's contribution to Federal employees' health insurance premiums increased by 6.7 percent. Applied against the FY 2007 estimate of $12,389,000, the additional amount required is $830,063.

Employees Compensation Fund (-$58,000) – The Employees' Compensation Fund bill for the year ending June 30, 2006, is a net $63,000 lower than for the year ending June 30, 2005. The STRS share of the decrease is $58,000.

Travel and transportation of persons	0	3

The General Services Administration increased the mileage rate from 40.5 cents to 44.5 cents, a 9.9 percent increase. This percentage was applied to the FY 2007 estimate of $28,000 to arrive at an increase of $2,772.

Rental payments to GSA 0 (4)

GSA rates are projected to increase by 2.4 percent in FY 2008. However, NIST plans to decrease usage of space in the Herbert C. Hoover Building.

Communications, utilities, and miscellaneous charges 0 7,536

Postage	$15
Electricity rate increase	2,166
Natural gas rate increase	5,355

Postage ($15,000) – The Governors of the Postal Service implemented a rate increase for first class mail from 37 cents to 39 cents, an increase of 5.4 per cent. This percentage was applied to the FY 2007 estimate of $280,000 to arrive at an increase of $15,120.

Electricity rate increase ($2,166,000) – PEPCO/RELIANT (Gaithersburg site) and Kauai Energy Services (Hawaii site) have had rate increases of 21.0 and 11.3 percent, respectively, per kilowatt hour for electricity service to NIST facilities. Applied to the FY 2007 estimates by site, the adjustment to base is $2,166,000.

Natural gas rate increase ($5,355,000) – Washington Gas (Gaithersburg site) and Seminole Energy Services (Boulder site) have had rate increases of 80.1 and 74.0 percent, respectively, per therm for natural gas service to NIST facilities. Applied to the FY 2007 estimates by site, the adjustment to base is $5,355,000.

Other services 0 88

Working Capital Fund (Departmental Management)	$37
Commerce Business Systems (CBS)	66
National Archives and Records Administration (NARA) storage costs	(15)

Working Capital Fund (Departmental Management) ($37,000) – An additional $37,000 is required to fund cost increases in the Departmental Management Working Capital Fund.

Commerce Business Systems (CBS) ($66,000) – An increase of $66,000 is required in FY 2008 consistent with the CBS Capital Asset Plan.

National Archives and Records Administration (NARA) storage costs (-$15,000) – NARA estimates reflect a decrease of $15,000 in FY 2008 for records storage and maintenance costs.

Scientific journal subscriptions	0	108

This adjustment to base addresses the FY 2005 to FY 2006 inflationary increase in costs for NIST's subscription journals. The Institute for Scientific Information (ISI) estimated this increase to be 8 percent. This factor was applied to a base of $1,346,000 resulting in an increase of $107,680. This amount exceeds the inflationary increases provided through the regular general pricing level deflator.

General pricing level adjustment	0	2,701

This request applies the OMB economic assumptions of 1.8 percent for FY 2008 where the prices that the government pays are established through the market system. Factors are applied to sub-object classes that result in the following adjustments to base: transportation of things $24,750; rental payments to others $31,554; communications, utilities, and miscellaneous charges $71,622; printing and reproduction $12,258; other services $1,465,715; supplies and materials $408,006; and equipment $685,656.

Subtotal, Other changes	0	23,295
Total, adjustments to base required	0	23,295
Less amount absorbed[1]	0	(12,030)
Total, adjustments to base requested	0	11,265

[1] *NIST will absorb $12,030,000 of adjustments to base in STRS through reductions in utilities, other services, supplies, and equipment.*

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: NIST laboratories
Subactivity: Laboratories and technical programs

Line Item		2006 Estimate Personnel	2006 Estimate Amount	2007 Continuing Resolution Personnel	2007 Continuing Resolution Amount	2008 Base Personnel	2008 Base Amount	2008 Estimate Personnel	2008 Estimate Amount	Increase/ (Decrease) Over 2008 Base Personnel	Increase/ (Decrease) Over 2008 Base Amount
Electronics and electrical engineering	Pos./Approp	253	$49,486	244	$50,942	244	$52,155	244	$52,155	0	0
	FTE/Obl.	225	49,762	229	51,303	229	52,046	229	52,046	0	0
Manufacturing engineering	Pos./Approp	111	21,829	106	22,454	111	24,994	111	24,994	0	0
	FTE/Obl.	107	22,848	109	22,837	113	25,041	113	25,041	0	0
Chemical science and technology	Pos./Approp	237	44,882	228	46,218	239	51,364	239	51,364	0	0
	FTE/Obl.	232	44,135	236	46,443	244	50,883	244	50,883	0	0
Physics	Pos./Approp	167	42,561	161	43,231	216	63,243	249	72,243	33	$9,000
	FTE/Obl.	166	42,033	175	43,639	217	60,837	242	68,337	25	7,500
Materials science and engineering	Pos./Approp	171	32,961	164	33,925	171	39,758	171	39,758	0	0
	FTE/Obl.	167	33,085	170	34,308	175	39,812	175	39,812	0	0
Building and fire research	Pos./Approp	118	21,729	113	22,398	117	24,972	125	32,222	8	7,250
	FTE/Obl.	111	22,163	113	22,514	116	25,018	122	32,268	6	7,250
Computer science and applied	Pos./Approp	324	63,690	312	65,702	328	71,391	328	71,391	0	0
mathematics	FTE/Obl.	312	66,435	327	69,185	339	71,512	339	74,762	0	3,250

Line Item		2006 Estimate		2007 Continuing Resolution		2008 Base		2008 Estimate		Increase/ (Decrease) Over 2008 Base	
		Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount
Standards and technology services	Pos./Approp	95	15,708	92	16,351	99	18,926	99	18,926	0	0
	FTE/Obl.	88	16,496	90	16,991	95	19,011	95	19,011	0	0
Innovations in measurement science program	Pos./Approp	68	15,617	66	16,068	69	20,453	69	20,453	0	0
	FTE/Obl.	68	16,260	75	16,162	77	17,281	77	17,281	0	0
Postdoctoral research associates program	Pos./Approp	92	10,406	89	10,918	89	11,351	89	11,351	0	0
	FTE/Obl.	92	9,923	94	12,065	94	11,368	94	11,368	0	0
Computer support	Pos./Approp	5	6,728	5	6,755	5	6,779	5	6,779	0	0
	FTE/Obl.	5	6,950	5	6,813	5	6,793	5	6,793	0	0
Business systems	Pos./Approp	33	10,444	32	12,155	32	12,361	32	12,361	0	0
	FTE/Obl.	30	10,439	29	12,262	29	12,427	29	12,427	0	0
External projects	Pos./Approp	0	11,888	0	0	0	0	0	0	0	0
	FTE/Obl.	0	11,888	0	0	0	0	0	0	0	0
Total	Pos./Approp	1,674	347,929	1,612	347,117	1,720	397,747	1,761	413,997	41	16,250
	FTE/Obl.	1,603	352,417	1,652	354,522	1,733	392,029	1,764	410,029	31	18,000

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: NIST laboratories
Subactivity: Laboratories and technical programs

Line Item	2006 Actual FTE	2006 Actual Amount	2007 Continuing Resolution FTE	2007 Continuing Resolution Amount	2008 Base FTE	2008 Base Amount	2008 Estimate FTE	2008 Estimate Amount	Increase/ (Decrease) Over 2008 Base FTE	Increase/ (Decrease) Over 2008 Base Amount
Electronics and electrical engineering										
WCF transfer		$200		$200		$200		$200		0
Reimbursables	124	46,173	135	35,411	135	35,619	135	35,619	0	0
WCF investments	0	(66)	0	167	0	0	0	0	0	0
Total	124	46,307	135	35,778	135	35,819	135	35,819	0	0
Manufacturing engineering										
WCF transfer		0		0		0		0		0
Reimbursables	47	8,403	51	9,417	51	5,888	51	5,888	0	0
WCF investments	0	(748)	0	120	0	0	0	0	0	0
Total	47	7,655	51	9,537	51	5,888	51	5,888	0	0
Chemical science and technology										
WCF transfer		350		0		550		550		0
Reimbursables	98	17,276	106	16,145	106	12,306	106	12,306	0	0
WCF investments	0	(601)	0	344	0	0	0	0	0	0
Total	98	17,025	106	16,489	106	12,856	106	12,856	0	0
Physics										
WCF transfer		500		0		2,500		4,000		$1,500
Reimbursables	122	25,702	131	27,339	131	25,925	131	25,925	0	0
WCF investments	0	(1,164)	0	183	0	0	0	0	0	0
Total	122	25,038	131	27,522	131	28,425	131	29,925	0	1,500

Line Item	2006 Actual FTE	2006 Actual Amount	2007 Continuing Resolution FTE	2007 Continuing Resolution Amount	2008 Base FTE	2008 Base Amount	2008 Estimate FTE	2008 Estimate Amount	Increase/ (Decrease) Over 2008 Base FTE	Increase/ (Decrease) Over 2008 Base Amount
Materials science and engineering										
WCF transfer		0		0		0		0		0
Reimbursables	20	4,257	21	6,596	21	3,934	21	3,934	0	0
WCF investments	0	(122)	0	360	0	0	0	0	0	0
Total	20	4,135	21	6,956	21	3,934	21	3,934	0	0
Building and fire research										
WCF transfer		0		0		0		0		0
Reimbursables	45	8,610	49	7,770	49	7,770	49	7,770	0	0
WCF investments	0	(332)	0	169	0	0	0	0	0	0
Total	45	8,278	49	7,939	49	7,770	49	7,770	0	0
Computer science and applied mathematics										
WCF transfer		0		0		0		0		0
Reimbursables	85	14,764	92	28,312	92	14,355	92	14,355	0	0
WCF investments	0	50	0	131	0	0	0	0	0	0
Total	85	14,814	92	28,443	92	14,355	92	14,355	0	0
Standards and technology services										
WCF transfer		0		0		0		0		0
Reimbursables	93	26,086	93	15,002	93	15,390	93	15,390	0	0
WCF investments	0	35	0	26	0	0	0	0	0	0
Total	93	26,121	93	15,028	93	15,390	93	15,390	0	0
Innovations in measurement science program										
WCF transfer		0		0		3,200		3,200		0
Reimbursables	0	0	0	0	0	0	0	0	0	0
WCF investments	0	4,768	0	885	0	0	0	0	0	0
Total	0	4,768	0	885	0	3,200	0	3,200	0	0
Postdoctoral research associates program										
WCF transfer		0		0		0		0		0
Reimbursables	0	0	0	0	0	0	0	0	0	0
WCF investments	0	8	0	5	0	0	0	0	0	0
Total	0	8	0	5	0	0	0	0	0	0

Line Item	2006 Actual FTE	2006 Actual Amount	2007 Continuing Resolution FTE	2007 Continuing Resolution Amount	2008 Base FTE	2008 Base Amount	2008 Estimate FTE	2008 Estimate Amount	Increase/ (Decrease) Over 2008 Base FTE	Increase/ (Decrease) Over 2008 Base Amount
Computer support										
WCF transfer		0		0		0		0		0
Reimbursables	0	0	0	0	0	0	0	0	0	0
WCF investments	0	1	0	0	0	0	0	0	0	0
Total	0	1	0	0	0	0	0	0	0	0
Business systems										
WCF transfer		0		0		0		0		0
Reimbursables	0	613	0	613	0	613	0	613	0	0
WCF investments	0	4	0	2	0	0	0	0	0	0
Total	0	617	0	615	0	613	0	613	0	0
Technical reimbursable services										
WCF transfer		0		0		0		0		0
Reimbursables	0	43	0	160	0	40	0	40	0	0
WCF investments	0	0	0	0	0	0	0	0	0	0
Total	0	43	0	160	0	40	0	40	0	0
Non-technical support services										
WCF transfer		0		0		0		0		0
Reimbursables	71	15,525	71	9,693	71	10,022	71	10,022	0	0
WCF investments	0	15	0	9	0	0	0	0	0	0
Total	71	15,540	71	9,702	71	10,022	71	10,022	0	0
WCF inventory and operating adjustments										
WCF transfer		0		0		0		0		0
Reimbursables	0	0	0	0		0	0	0	0	0
WCF investments	0	12,054	0	0	0	0	0	0	0	0
Total	0	12,054	0	0	0	0	0	0	0	0
Total										
WCF transfer		1,050		200		6,450		7,950		1,500
Reimbursables	705	167,452	749	156,458	749	131,862	749	131,862	0	0
WCF investments	0	13,902	0	2,401	0	0	0	0	0	0
Total	705	182,404	749	159,059	749	138,312	749	139,812	0	1,500

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
LABORATORIES AND TECHNICAL PROGRAMS

Goal Statement

This subactivity supports the NIST goal to promote innovation, facilitate trade, and ensure public safety and security by strengthening the Nation's measurement and standards infrastructure, and the Department of Commerce strategic goal to promote U.S. innovation and industrial competitiveness by protecting intellectual property, enhancing technical standards, and advancing measurement science.

The NIST Laboratories play a unique role in the Nation's scientific, industrial and business communities. NIST's role in the Nation's measurement and standards system enables companies, researchers, government agencies and universities to work with each other, thereby enhancing and improving the Nation's economic security and quality of life. When scientists, engineers, health care professionals, manufacturers and business people compare and trade data, test results, manufactured goods, and commodities, they do so with confidence in the exchange because of NIST's presence in the background, anchoring the national measurement and standards system that is the language of research and commerce.

This is the oldest and one of the most important of NIST's long-standing missions. This NIST mission affects every American who goes to the store, buys gasoline or pays a utility bill because each year $4.5 trillion in wholesale and retail trade is measured against standards that are ultimately traceable to NIST. It affects every American whose job depends on the ability of our industries to innovate and to compete in global trade, because product quality and productivity depend on the ability to measure and precisely control the production process, and because more and more high-tech and high-value products are subject to foreign regulations that require measurements traceable to internationally recognized standards. It affects every American who relies on fundamental business services and communications devices, because so many of these services depend upon NIST measurements and standards in ways that are invisible to most consumers and service sector employees. It affects every American concerned with homeland security because NIST is being called upon increasingly to provide the measurement assurance behind sensitive detection systems for chemical, biological, explosive or radiological weapons. It is a vital mission, and one that is far from static, because a modern, progressive, industrialized society imposes constant demands for improvements in its measurements and its standards. The pace of America's

technological innovation both drives and is driven by our ability to observe and to measure, and NIST's infrastructure is vital to the pace of innovation.

More fundamentally, in field after technological field and sector after economic sector, NIST Laboratories help answer the question "How do you know...?" As the only Federal science and technology agency whose primary mission is to support economic growth and competitiveness of the United States in global markets, NIST pursues this mission across the entire economy.

How do you know –
...the magnetic field of a micrometer-wide dot? This information is needed in order to develop future generations of fast, ultra-high capacity data storage devices. NIST scientists have built microscopic torque magnetometers that can measure magnetic films and dots with a resolution finer than a single atomic layer.

...if there are toxic chemicals in a water supply? NIST scientists have developed an inexpensive "lab-on-a-chip"–a miniaturized chemical and biochemical analysis system based on the natural response of bacterial cells to toxins that provides warning within seconds of even trace amounts of toxic chemicals in water.

...which of tens of thousands of possible formulations for new adhesives (a $30 billion global market) performs the best? NIST has launched a project with key industrial partners to develop new "combinatorial" techniques that can rapidly screen thousands of combinations of new epoxies, pressure-sensitive adhesives and similar products for desired properties.

...whether an emergency communications system will work properly for first-responders during a major disaster? NIST researchers are developing new techniques to solve problems of communications equipment incompatibility and to assess how the systems work in real disaster conditions as part of wide-ranging research in support of the Nation's emergency first responders.

...what time it is? It is well known that NIST maintains the primary national standard for time and frequency measurements. What is less appreciated is the pervasive impact of this work, which includes the time-stamping of electronic financial transactions, telecommunications, electric power transmission, transportation, navigation (including support of the Global Positioning System), and defense applications.

These are just a few examples of NIST's support to the economic growth and competitiveness of the United States in global markets. NIST is entrusted to answer the question "How do you know...?" and to provide reliable and accurate measurements required for countless national needs. In order to do this, NIST must maintain its status as a trusted partner that is based on its reputation for objectivity, neutrality, and technical excellence.

Base Program

NIST's support of measurements, standards and technology–a mission which embraces everything from validating the testing system used to assure the quality of concrete in new construction to the frontiers of quantum computing and quantum-level encryption–is funded under the Scientific and Technical Research and Services (STRS) appropriation, and includes eight technical and four centrally-managed programs:

1) Electronics and Electrical Engineering - Assisting a huge section of the established and emerging industrial landscape, NIST supports the U.S. electronics (shipments, both domestic and international, of $405 billion in 2004) and electric power (sales of $270 billion of electricity in 2004) industries and the electrical equipment industry (shipments of $107 billion in 2003). The U.S. electronics and electrical equipment industries (including computer, communications, semiconductor component and equipment manufacturing) employed over 3 million people at the end of 2005 (projected), and the products of these industries, representing over $750 billion in U.S. shipments annually, support other major manufacturing and service industries, such as the automotive, aerospace, and health-care industries. As with all high-tech industries, electronics is highly dependent on measurement. In 2006, for example, it is estimated that the semiconductor industry will spend approximately $9 billion on measurement services. This investment is highly dependent on a comprehensive infrastructure support program from NIST, as demonstrated by a number of economic impact studies of NIST programs.

NIST's work in this programmatic area includes maintaining and improving existing measurement references and standards, developing new measurement technologies and ways to tie needed measurements to fundamental national standards, and pursuing basic research on electronic devices and the processes used to manufacture them. The research concerns of NIST touch nearly every aspect of today's high-tech electronics, including the fundamental properties of semiconductors and semiconductor devices; new materials and technologies for magnetic data recording; electronics for information technology and communications; electronic measurement instrumentation; fiber optics; optoelectronics; superconducting electronics; radio-frequency electronics; and the new fields of microelectromechanical systems (MEMs) and nanoscale electronic devices. NIST's leadership and diligence are credited, in a large part, with the successful development of a new broadband wireless standard that dramatically extends the capability of the previous WiFi standard.

NIST also provides the fundamental measurement expertise that underlies the Nation's electric power grids, helping to assure the accuracy of electric power and energy metering and the integrity of the system. It provides the foundation for all electrical measurements by maintaining the national standards for voltage, resistance, capacitance, current and power (including electrical, microwave and laser). NIST's work in electronics-based sensors and instrumentation has broad impacts in homeland security and

public health and safety. The aerospace and defense industries rely on NIST's expertise in antenna measurements when designing and using systems for satellite communications, navigation, aircraft collision-avoidance, weather monitoring, earth surveying, and defense and homeland security. This program also includes the NIST Office of Law Enforcement Standards (OLES), which helps homeland security and criminal justice agencies ensure that the equipment they purchase and the technologies they use are safe, dependable, and effective.

NIST research focuses on industry and government priorities, as demonstrated by these recent examples:

- NIST helped accelerate the development of a new class of high-speed electronic devices by creating a measurement system that is the first to fully characterize the response of next-generation optical communication components. Using a unique application of microwave and electro-optic technologies, NIST provided the world's first service to measure both amplitude and phase at very high frequencies with a method that is traceable to fundamental units. This advance allows industry to characterize high-speed electrical and optoelectronic devices up to unprecedented frequencies, and commercial products taking advantage of this new calibration technique were released within nine months after proof of concept.
- NIST has developed new "best-in-the-world" capability to measure gamma-rays for nuclear nonproliferation purposes. This world's record energy resolution will allow the plutonium content of spent reactor fuel, including weapons-useable fissile material, to be measured with a stand-off, non-destructive technique. Demonstration of this improved monitoring technology is being conducted in collaboration with Los Alamos National Laboratory. This gamma-ray technology is based on highly successful cryogenic microcalorimeter x-ray detector technology developed at NIST over several years to support improved nanoparticle detection in the semiconductor electronics industry and for use in future x-ray astronomy missions. NIST also recently demonstrated a new world's-best x-ray detector and NIST researchers expect to further improve the sensor performance to reach the aggressive resolution goal set by the National Aeronautics and Space Administration, which will enable future planned x-ray satellite missions to better determine the temperature and motion of matter in space.

NIST's FY 2008 base program operating objectives in electronics and electrical engineering include the following:

- Develop, characterize, implement and improve quantum-physics-based systems for fundamental electrical metrology applications, including increasing the voltage output and bandwidth of AC voltage standards and implementing a single-electron-pump-based capacitance standard with improved frequency dependence.
- Develop a prototype solid-state quantum computation system based on superconducting Josephson junctions.
- Develop, characterize, and improve the NIST electronic kilogram (watt-balance) experiment linking electrical and mechanical power to provide for the eventual redefinition of the kilogram. The kilogram is the only remaining base unit in the International System of Units whose definition is based on a physical, rather than on fundamental, properties of nature.

- Provide electrical and reliability measurement techniques, data, physical models and fundamental understanding for ultra-thin silicon dioxide and alternate materials to enhance the reliability of advanced insulating films.
- Develop the measurement tools and infrastructure necessary to predict, measure, and control the flow of charge through molecules and ensembles of molecules. Molecular test structures being developed at NIST will enable industry to perform robust, reproducible measurements of the electrical properties of molecules and will support better fundamental understanding of molecular devices.
- Develop the capability to characterize electrically active defects in organic field effect transistors as part of our larger program to support development of future inexpensive, ubiquitous organic-based electronics.
- In response to continued industry needs for high-speed communications and test instrumentation including high-speed oscilloscopes, develop and demonstrate new frequency-domain and time-domain metrology for fast waveforms using electro-optic sampling, with verified traceability to fundamental physical units.
- Characterize and develop metrology for key photonic materials critical to advances in lasers and solid state lighting. Developing an understanding of the role of defects in these materials will accelerate their use in data storage, microwave communications, and high-power, high-temperature electronics.
- Develop measurements and fabrication methods for nanowire laser arrays operating from the ultraviolet to the visible for use in nanoscale microscopy and sensor applications.
- Characterize, implement and improve the source of regulated single photons using semiconductor quantum dots for use in improving the accuracy of optical power measurements–especially in the low power range–and provide calibration of photon-counting avalanche photodiodes to test algorithms for quantum cryptography, an emerging area of ultra secure communications.
- Characterize, implement and improve the quantum efficiency of single-photon-sensitive energy resolving optical detectors that were developed at NIST to demonstrate usefulness for optical radiometry and quantum cryptography applications.
- Develop the measurement infrastructure needed to support accurate Optical Coherence Tomography measurements for biological tissue characterization, and identification and determination of cell nucleus size, which may be an important early indicator of cancer.
- Develop the metrology needed to support quantitative biomagnetic imaging, including characterization of Magnetic Resonance Imaging (MRI) contrast agents and standards over a broad range of fields and frequencies.
- Develop new sensors and imaging technologies for homeland security and other applications, based on radar, x-ray, gamma-ray, terahertz, microhotplate (chemical gas sensing) and nanoengineered magnetic sensor technologies.

- Develop large, fast, high-energy-resolution cryogenic x-ray detector arrays that will provide unique materials analysis capabilities for user instruments at the National Synchrotron Light Source at Brookhaven National Laboratory.
- Demonstrate new capability to measure the electric and dielectric properties of nanowires at microwave frequencies.
- Develop key techniques for characterizing ultra small magnetic structures and improved methods for measuring the switching time of magnetic domains needed to support the magnetic data storage industry. These methods, especially as related to micromagnetic imaging, also benefit the forensic and homeland security communities.
- Develop and improve measurement methods for spin electronic, or "spintronic," devices (e.g., nano-scale devices whose properties are based on the quantum mechanical "spin" of electrons rather than their electrical charge), including new spin-transfer nano-oscillators recently developed at NIST.
- Support the electrical utilities and related industries by providing measurement services for electric power, energy, and current, including power metering and the development of new calibrations of synchronous voltage and current sensors to support real-time monitoring of the electric power grid.
- Provide closely coupled theoretical and experimental technical support for industry and representation on international normative standards committees to facilitate the adoption of technically sound and cost effective test methods for international electromagnetic compatibility conformity standards that are equitable to U.S. industry.

2) Manufacturing Engineering - Manufacturing is widely recognized as a key sector of the Nation's economy, driving growth both directly and indirectly. NIST, a key supporter of manufacturing, helps U.S. industry compete from the "high ground" of advanced manufacturing technologies and capabilities. NIST concentrates on technologies and standards that enable interoperable manufacturing systems and the extended manufacturing enterprise, a strategy to facilitate the introduction, upgrade and maintenance of state-of-the-art technologies for integrated design, manufacturing and quality control. This work includes researching and developing open-system standards for intelligent manufacturing systems, interface standards, and frameworks for integrating entire enterprises throughout the supply chain. The continued competitiveness of U.S. manufacturing requires technical infrastructure from NIST, not only to support product and process R&D, but for the increasingly critical information infrastructure that enables efficient supply chain integration.

Nanoscale manufacturing is the sector's most hotly competed front, and NIST leads the Federal government's nanomeasurements efforts. NIST conducts some of the Nation's most advanced nanotechnology research, developing techniques to calibrate measurement standards to sub-100 nanometer (nm) accuracy. NIST's nanomanufacturing research focuses on both state-of-the-art practice as well as gaps in technology for achieving accurate, repeatable measurements of the nanostructured materials, devices and systems. Advanced nanomanufacturing is the key to the strength and future growth of the U.S. manufacturing sector and must be fostered for the United States to maintain its lead in nanotechnology and nanobiotechnology.

Industry, government, and national defense operations rely more on information technology than ever before–including most aspects of production and distribution. They depend on an interdependent network of critical information systems, many of them with access to the Internet. Hundreds of thousands of older systems already in use in industry were designed and placed in use when security was at best an afterthought. NIST is working to improve the security of these real-time industrial control systems and accelerate development and deployment of systems with new and enhanced capabilities that will help protect lives and property.

Enterprise integration and the importance of standards in manufacturing have become paramount for this Nation's large manufacturers. They rely on a system of small manufacturers, parts suppliers, shippers, and raw materials producers organized in extended enterprises called supply chains. The demands placed on these supply chain providers will increase with the greater demands placed on large manufacturers competing for a place in the global marketplace. In many respects, international standards will define access to the global marketplace. NIST is expanding its programs to provide technical assistance to standards developers, the transportation and construction industrial sectors, and pilot implementations to further the integration of the global supply chain. The impact of enterprise integration for U.S. manufacturers in targeted sectors includes:

- Job creation as a result of improved productivity;
- Global competitiveness and increased business opportunities for manufacturers;
- Opening the global marketplace to the U.S. small manufacturing community;
- One billion dollars in enterprise integration costs savings by reducing data errors, data re-entry, and redundant systems;[1]
- Twenty percent reduction in time-to-market for manufacturers and producers in targeted industries; and
- Potential extension of enterprise integration benefits to the shipbuilding, furniture manufacture, chemicals production, textiles, and apparel industrial sectors.

[1] *Interoperability Cost Analysis of the U.S. Automotive Supply Chain.* (RTI Planning Report 99-1), March 1999. http://www.nist.gov/director/prog-ofc/report99-1.pdf

World-class traceable measurements provide the foundation for research, innovations, and products for a wide variety of applications. To compete in the national and international markets, companies rely on traceable mechanical and dimensional measurements to develop, test, and market quality products that are structurally sound, functionally superior, and safe. NIST's work in dimensional and mechanical measurements (i.e., acoustics, force, mass, and vibration) impact science research and the manufacturing industry, as shown in these examples:

- Piloted the 4 mega Newton international key comparison in Force. A report and data analysis were submitted to the International Committee of Weights and Measures (CIPM) Consultative Committee for Mass and Related Quantities' (CCM) Working Group on Force. It is critical that NIST maintain its measurement capability because accurate force measurements are required in almost all industries for things such as testing mechanical structures (e.g., bridges, aircraft, and medical prosthetics) and for testing the strength of materials, assuring quality control in production lines, measuring engines thrust, and even certifying load cells used within weighing systems.
- Standard bullets are now available for law enforcement laboratories. The standard bullets are intended for verification of automated optical equipment and their linked databases for inspecting and matching bullets in crime labs under the National Integrated Ballistics Information Network led by the Bureau of Alcohol, Tobacco and Firearms. A set of standard reference material (SRM) documents for the SRM 2460 standard bullets was also completed.
- Advanced real-time compensation of geometric errors in a machine tool, to include leadscrew, straightness, angular, squareness, and parallelism errors. Manufacturers face international competition to produce quality parts in less time with less cost. Many researchers agree that manufacturing needs to move towards a science-based understanding, optimization, monitoring and control of the available machining processes and equipment–one without significant time spent on process development, setup or unexpected down time is needed to make major innovations in this field. NIST leads the effort to create a science-based understanding of machining systems.
- A major milestone was reached in the standardization of Process Specification Language (ISO 18629). Process data are used throughout the life cycle of a product, from early indications of manufacturing process flagged during design, through process planning, validation, production scheduling and control. The PSL standard supports the unambiguous description and exchange of process information.
- NIST is helping to reinvent the basic manufacturing environment, enabling dramatic improvements in the productivity and cost of designing, planning, producing, and delivering high-quality products within short cycle times. NIST's efforts in modeling and characterization of machine tools and machining processes, defining data and interface requirements between design and production equipment, as well as methods and standards for machine performance monitoring, contribute significantly to this large industry need.

NIST's FY 2008 base program operating objectives in manufacturing engineering include the following:

- Define and apply information security requirements, standards, and test methods for industrial control systems. While many security experts agree that physical attacks are the most immediate threat to critical infrastructures, they recognize the need to secure industrial control systems from cyber attack as well. NIST's researchers are leading the effort to develop guidelines and performance metrics for industrial control systems.
- Develop a metrological theory that can be used to measure and compare information objects. This is the first step towards developing an underlying science base, a measurement infrastructure, and the testing tools that will be needed to support the development of an integrated business ecosystem. The current set of standards is insufficient, since they focus only on data, without any understanding of the meaning of those data. This is costing American companies tens of billions of dollars per year and negatively impacting both our economic competitiveness and our ability to innovate.
- Construct a new state-of-the-art reference dimensional metrology Scanning Electron Microscopy (SEM) and accurate measurement methods for full-size silicon wafers and masks. These tasks are on the critical path for the International Technology Roadmap for Semiconductors (ITRS); ITRS projects will stall without research breakthroughs in this technical area. These advances aid the $200 billion semiconductor industry, where even relatively small improvements in metrology such as these can yield large savings and increased value to the economy.
- Develop the capability to measure aspheric optics needed for consumer products such as the next-generation digital cameras and DVDs. Precision Engineers in these consumer industries have identified the need for traceable measurement of aspheric optics. Only a small number of very specialized optical companies practice the metrology of aspheric and free-form optics. The barrier to entry to this field is high in both capital equipment and expertise. NIST seeks to lower this barrier by making this form of optical measurements available to a wide array of smaller manufacturers.
- Establish and upgrade the mass and vibration laboratory space, which will ultimately result in expanded calibration services. Building a mass and solid-density measurement facility will optimize the measurement process. Accurate low-frequency vibration measurements are important for human whole-body vibration response, vehicle ride control, and seismic monitoring. U.S. industry relies on NIST measurements to establish a level playing field in international standards and to ensure international recognition of measurements.
- Develop the Next Generation baseline measurement system and test method concepts for measuring the performance of Integrated Vehicle Based Safety Systems in preventing highway crashes. This effort supports the Department of Transportation's efforts to achieve deployment of advanced driver safety systems in all new vehicles.
- Develop health and reliability metrics for major machine components and systems to verify that the machine and the process are operating within expected design limits. Unscheduled downtime of manufacturing equipment is one of the most important

impediments to achieving cost-effective, timely production schedules. NIST's work in Smart Machining Systems will result in gains in productivity, decline in inventory requirements, and manufacturing related product improvements, through both lower price and higher quality.

- Develop and demonstrate a near-term standards-based solution for integrating the functions and data associated with supply chain business and production management. NIST's work will help manufacturers remain competitive by giving them the means to reduce costs and improve their economic competitiveness.
- Complete measurements and analyze results of the International key comparison in both mechanical standards and length standards. Participation in international key comparisons shows a comprehensive picture of how measurement standards here at NIST formally compare with National Measurement Institutions–in other words, their metrological equivalence. This effort facilitates trade between the United States. and other nations, including the European Union, by ensuring that measurements made in one country will be recognized in another country.
- Build an evolving infrasonic test-bed to supplement measurements in the audible frequency range. Man-made events such as rocket launches, airbag deployment, supersonic aircraft travel, and explosions resulting from nuclear weapons tests may be monitored with acoustical measurements at infrasonic frequencies. By building a capability in this area, NIST researchers will enable scientists to compare signals taken at different times with different equipment.

3) Chemical Science and Technology - NIST is the Nation's primary reference laboratory for chemical measurements, and promotes commerce, improved quality of life and innovation in the United States in the areas broadly encompassed by chemistry, biosciences, and chemical engineering. NIST develops and disseminates the standards needed to support measurements of national interest, assuring that U.S. industry has access to accurate and reliable data, and predictive models to determine the chemical and physical properties of materials and processes. NIST's efforts address next generation standards and data needs that underpin the development, implementation and/or assessment of new technologies in critical industries such as biotechnology, pharmaceuticals, chemical manufacturing, health and medical products, and energy production. NIST measurements also support environmental research and monitoring, food and nutrition analysis, criminal forensics, and homeland security (especially for chemical, biological, radiological, nuclear and explosives threat detection).

NIST's work in chemical measurements ranges from gathering and validating property data for thousands of chemical compounds to developing sensitive new technologies for DNA analysis. An example includes measurements and standards for the in vitro diagnostic (IVD) industry and clinical measurements community. The sequencing for the human genome opened new vistas for NIST scientific expertise and married disparate areas such as forensic DNA technologies and organic analysis to provide next generation health status markers such as Troponin, an indicator of heart attack, and mitochondrial proteomics to diagnose genetic diseases. NIST's expanding biosciences program is pursuing measurement and standards research in tissue engineering, quantitative cancer biomarkers, gene

expression, proteomic-protein microarrays and bio-nanoelectromechanical systems, and is contributing to NIST's expertise in microfluidics and molecular-scale electronics. NIST maintains the national standards for temperature, pressure, vacuum, leak rate, fluid flow, humidity, liquid density, volume, air speed, pH, and electrolytic conductivity. In nanotechnology, NIST researchers are pioneering spatially-resolved chemical analysis at the nanoscale that impact areas ranging from nanomanufacturing to climate change research and extend to homeland security.

An example of the reach of NIST's work in chemical measurements is the use of the gas chromatograph-mass spectrometer (GC-MS), which has become a standard industrial tool for chemical analysis, particularly for the detection and identification of trace levels of chemicals or contaminants. The mass spectrum of a substance is often called its "chemical fingerprint," and, like fingerprints, relies on having a large library of reliable mass-spectral data. After three years of development, NIST has released a major upgrade of the widely used NIST/EPA/NIH Mass Spectral Library. The new edition of the library, NIST 05, adds approximately 20,000 new spectra, bringing the total number of compounds found in the database to more than 163,000. Each spectrum has been analyzed and critically evaluated to ensure that the library has the best possible current data. The upgraded library also includes two important new classes of chemical reference data. Gas-phase "retention index" data–used in gas chromatography to identify volatile organic compounds–have been added for more than 25,000 different compounds. And a separate collection of more than 2,000 tandem mass spectrometry (MS/MS) spectra has been added. MS/MS spectra arise from a process where the ionization and fragmentation steps are separated. They have become widely-used "fingerprints' for compounds in complex biological samples in fields such as proteomics and metabolomics. This is the first evaluated, general purpose MS/MS data library available to the general public. The range of users is vast. GC-MS is used to ensure the safety of food and drugs; monitor aerospace engine and fuel performance/characteristics; verify the quality of critical vehicle, ship and aircraft components; ensure the manufacturing quality of semiconductor chips and camera lenses; and control oil extraction and meter gas flow in pipelines. In national defense, GC-MS underpins the safety of nuclear installations and is used to control weapons proliferation; in the detection of explosives; contaminants in drinking water; and the detection and identification of chemical and biological agents.

NIST's FY 2008 base program in chemical science and technology includes enhanced objectives in advanced measurements, standards and data for chemical processes, nanotechnology, bioscience and health care measurements, and chemical and bio-informatics. These objectives include the following:

- Develop methods to rapidly measure genetic variation at the DNA and RNA level that can be applied to human identity testing or high-throughput pharmaceutical drug discovery. These efforts are being conducted to assure that the accuracy and precision of DNA/RNA testing in the United States is based on well-qualified standards produced and certified at NIST.
- Develop measurement methods (such as quantitative fluorescence labeling of DNA) to support gene expression methodologies such as microarrays and flow cytometry.

- Develop innovative reference materials and measurement procedures for proteomics-based clinical biomarker discovery. Rapid advances in technology and improvements in the methodologies for protein identification have been enablers for clinical biomarker discovery. This clinical stage is critical to successful realization of the promise of the rapidly expanding field of proteomics to produce major breakthroughs in disease diagnosis and treatment. Recent experience has greatly undermined confidence that the measurements can be sufficiently accurate to diagnose or predict the occurrence of cancer. NIST has been asked by the National Cancer Institute to specifically address the standards needs for cancer biomarker proteomics.
- Develop higher order standards, reference methods, and certified reference materials to underpin the accuracy of tests for health status markers such as the development of a new series of standards for hormones in human serum. Hormones regulate metabolic processes such as thyroid function, sexual maturation, and metabolism of fats and carbohydrates. Abnormal levels of hormones can be directly related to some of the most common human diseases, from heart disease and obesity to depression. The accuracy of tests, such as these, help health care personnel defines the course of treatment. Erroneous or inaccurate results can lead to inappropriate treatment, further health complications and increased costs for healthcare.
- Develop measurement methods and standards to enable a new generation of molecular imaging tools, allowing the identification and treatment of cancers, image-guided surgeries, and directed drug therapies.
- Develop new protocols and reference materials to support quantitative cell-based imaging to support new drug development and new therapies and diagnostics.
- Develop measurement methods, data, and models at nanometer spatial scales to improve chemical measurements and to characterize the chemical nature of nanotechnology devices and materials. This will help enable U.S. industry to characterize and manipulate the physical and chemical nanoscale structures in commercial devices.
- Investigate the structure of molecular electronic devices and the charge transport through these molecules, using sophisticated optical spectroscopies and scanned-probe instruments. These molecular systems are being investigated to validate predictive models critical for U.S. industry to evaluate, produce, and utilize molecular electronics.
- NIST will expand the utility and functionality of the NIST Thermophysical Properties of Pure Fluids Database by improving the mixture models in conjunction with projects on natural gas systems and refrigerants. NIST will enable the adoption of next-generation ozone-friendly and energy efficient refrigerants by completing measurement of vapor-liquid equilibria and molecular association of key industrial binary systems.
- Assess and improve the global comparability for chemical and biochemical measurements by leading and participating in international studies conducted under the auspices of the International Bureau of Weights and Measures. These studies and key comparisons are focused on determining the scope, applicability, limitations, and use of various methods and techniques for assessing the purity and stoichiometry of organic and inorganic compounds; and the applicability of various methods for the

measurement of various constituents in blood and other body fluids, food, environmental samples and hi-tech materials. These activities will continue the establishment of an international comparability structure for measurements in chemistry and are instrumental in ensuring efficient and fair international trade.

4) Physics - NIST meets the Nation's measurement needs in many critical areas of physics, most notably atomic and optical physics, electronic and magnetic technologies, and ionizing radiation. NIST also performs world-leading basic research in fundamental physical quantities and quantum physics.

NIST's expertise in these areas of measurement impacts a broad range of science and industry, including:

- Optical products–the optical products industry is a $100 billion sector, including commercial and industrial lighting, photography, microscopy, xerography, color and appearance, paints and dyes, spectroscopy, and imaging. Remote sensing is a major industrial use for optical radiation calibrations. Work at NIST is important for environmental monitoring instruments used to monitor global warming, ozone depletion, and other large-scale climate issues.
- Optical properties–surface finish and appearance are make-or-break quality issues for many products. NIST calibrations of surface reflectance and gloss help maintain quality control for automobile finishes, the appearance of consumer goods, and other manufactured products. Uniform measurement and representation of product appearance is required for the decentralized manufacturing enterprises, where product design, development, and production occur in separate locations.
- Medical radiation–NIST calibrations underlie the safety and efficacy of diagnostic procedures, such as mammography, and therapeutic procedures, such as brachytherapy (used to treat prostate cancer). Well in excess of 20 million therapeutic radiation procedures,[2] and more than 33 million x-ray mammograms[3] *annually* are traced to NIST standards.
- Biotechnology–NIST researchers are developing ultrasensitive measurement tools using fluorescence detection of single molecules to help resolve a critical issue in enzyme activity.
- Public health and safety–NIST expertise in radiation detection and measurement supports critical work of the Department of Homeland Security (DHS) through facilities such as the NIST Cargo and Truck Inspection Testbed. This testbed improves the

[2] All therapeutic radiation procedures performed in the United States must be traceable to NIST standards. According to the American Cancer Society (http://www.cancer.org), there will be approximately 1.4 million newly diagnosed cancers in the United States in 2006. Approximately 60 percent of cancer patients are treated with radiation therapy during the course of the disease. An estimate of the number of cancer patients treated annually using radiation therapy is, therefore, about 824,000. Each patient will have a total of between 25 and 30 fractionated dose procedures (between 20 million and 25 million individual procedures performed annually). Therapeutic radiation procedures are also used for diseases other than cancers. However, statistics on these are not available.

[3] All mammograms performed in the United States must be traceable to NIST standards. As of April 1, 2005, 33 million mammograms were being performed annually. See http://www.fda.gov/cdrh/mammography/scorecard-statistics.html.

ability to test commercially created, homeland security radiation detectors, and also helps in the development of a high sensitivity neutron spectrometer for detecting fissile materials in transit.

NIST also maintains the Nation's standards for time and frequency measurement, and is developing innovations in new time and frequency standards. NIST focuses on developing the highest accuracy time standards, commensurate with NIST's mission of developing and maintaining the U.S. national measurement standards, and focuses on distributing very accurate time for civilian applications such as time-stamping of financial transactions, setting of many millions of computer clocks daily through the Internet, setting of many millions of consumer timepieces daily through radio broadcasts, calibration of civilian research and measurement equipment for telecommunications and other applications, synchronization of electric power grids, and many other mission-critical applications. NIST has a robust, world-leading research program in developing new time standards such as the NIST F2 laser-cooled fountain clock, new methods of time distribution such as the Internet Time Service, and new levels of accuracy in satellite time transfer.

NIST's work in physics ranges from today's urgent needs to the foundations of tomorrow's technology:

- NIST researchers in the Time and Frequency Division have invented an atomic clock so small that its inner workings are about the size of a grain of rice. The microminiaturized atomic clock–believed to be 100 times smaller than any other atomic clock–opens the door to atomically precise timekeeping in portable, battery-powered devices for secure wireless communications, more precise navigation, and other applications. It can be fabricated and assembled on semiconductor wafers using existing techniques for making micro-electro-mechanical systems (MEMS), offering the potential for low-cost mass production of an atomic clock about the size of a computer chip and permitting easy integration with other electronics. The clock consumes less than 75 thousandths of a watt (enabling the clock to be operated on batteries) and is stable to one part in 10 billion, equivalent to gaining or losing just one second every 300 years. A new magnetic sensor based on the principles of the chip-scale atomic clock also has been announced. Expected applications for a commercialized version of the new sensor include hand-held devices for sensing unexploded ordnance, precision navigation, geophysical mapping to locate minerals or oil, and medical instruments.
- NIST works with all the major automotive manufacturers and developers of hydrogen fuel cells at a special neutron-imaging facility at the NIST Center for Neutron Research. Neutrons allow real-time imaging of the fluid-flow in fuel cells, similar to the way x-rays allow medical imaging of bones and other organs. The information obtained from this facility allows fuel-cell engineers in the private sector to develop increasingly more powerful, efficient, and durable designs. The National Research Council has reported that, "The NIST effort ... is a considerable achievement and one of the most significant analytical advances in

the membrane fuel cell realm in decades. The NIST facility offers the entire fuel cell community unique research opportunities that previously eluded them."[4]

- For health care, NIST conducts research on standards to enable hospitals to use nuclear medicine more effectively. NIST has developed methods to image single biomolecules and use terahertz radiation for measuring biomolecular processes. NIST has also done work on investigating fluorescent quantum dots–small, nanoscale particles–as part of a process to rapidly diagnose specific infections.
- NIST is at the forefront of the nascent field of quantum information processing–computing and communications–challenging preconceived notions of computational complexity and communications security. Similarly, NIST has been a leading center for metrology at the nanoscale, even before "nanotechnology" gained prominence, and pioneered electron-spin microscopy, which images magnetic materials. The Institute's unique extreme ultraviolet optics facility supports the electronic industry in its drive to develop advanced lithographic systems for producing ever smaller chips. Today, major effort goes into understanding and learning how to better measure the interactions of single photons–the fundamental constituent of light–with nanoscale structures and objects.

NIST's FY 2008 base program operating objectives in physics include the following:

- Develop a model for specifying illumination quality of light-emitting diode (LED) lighting. White lights made from LEDs (e.g., for illuminating architectural spaces) provide gains in energy efficiency, but are not well assessed by traditional lighting metrics.
- Demonstrate spatially resolved, quantitative colorimetry for medicine in a clinical environment, using hyperspectral imaging, to improve the objectivity of subjective tissue measures.
- Establish standards infrastructure for commercial-grade quantum cryptography.
- Develop absolute dosimetry of pulsed extreme-ultraviolet sources for next-generation semiconductor lithography.
- Develop, with user community, new standards to help establish uniform procedures for active (neutron) interrogation methods for non-intrusive inspection of cargo and baggage for homeland security applications, and develop the critical measurement infrastructure for the accurate and sensitive background measurements crucial for passive detection of contraband nuclear material.
- Integrate cavity-ringdown spectroscopy and optical comb techniques to enable parallel high sensitivity molecular "finger printing" of trace gases (such as those indicating explosives or chemical weapons).

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[4] *Review of the Research Program of the FreedomCAR and Fuel Partnership: First Report*, Committee on Review of the FreedomCAR and Fuel Research Program, National Research Council (2005), p. 65; available electronically at http://fermat.nap.edu/books/0309097304/html/25.html

- Develop new methods to improve the measurement of microwave noise in radars, telecommunications systems, and other systems based on laser frequency comb technology (which was recognized with the 2005 Nobel Prize in Physics to a NIST researcher).
- Demonstrate a double-well lattice for neutral atoms, a key component for building a rudimentary neutral atom quantum processor.

5) Materials Science and Engineering - In the global race to develop new technologies and products, "materials problems" are often a critical barrier to progress. These problems might take the form of anticipating how the modification of molecular structure and composition will affect the performance of innovative designer materials, or determining the optimal conditions and methods for efficient, affordable processing to expand the applications of existing materials.

Through its materials science and engineering research and services, NIST directly contributes across the entire spectrum of materials, including metals, polymers, and ceramics. NIST develops tools that accelerated process development and manufacturing for established industries; these tools include combinatorial methods to accelerate new materials development, benchmark materials data to enable industrial designs, and standard measurement methods to shorten development time. NIST also anticipates the needs of next generation industries by supplying advanced metrology for electronics, magnetics, optoelectronics, and biomaterials, and by conducting the fundamental science to enable the development of nanomaterials and devices, including standards and methods for nanocharacterization and measurement methods for mechanical and wear properties at the nanoscale.

Industry scientists and engineers, university researchers, national and international standards organizations, and other technical communities rely on NIST for its technical expertise, objectivity, measurement methods, materials databases, practice guides, and standard reference materials.

Recent NIST accomplishments include:

- NIST completed a three-year investigation of the World Trade Center Disaster. A critical aspect of the investigation was the metallurgical analysis of the recovered structural steel. NIST issued six reports, and work continues on issues involving the use of fire-resistant steel.
- NIST has begun the development of Atomic Force Acoustic Microscopy (AFAM) for rapid, accurate visualization of in-situ mechanical properties with nanoscale spatial resolution. The results of this work will be used to predict the reliability and performance of nanomechanical devices. This will establish NIST as a world leader in metrology solutions for nanomechanical applications and open up rapid evaluation of soft materials, possibly including biological structures.
- A new x-ray system is being used to measure stresses in sheet metal as it is formed into a complex shape. These unique data have been incorporated into a next-generation set of benchmarks that are used to test simulations, and will allow designers of stamping dies for automotive parts to increase the accuracy of die designs and reduce very costly tryout periods.

- In partnership with Intel and the industrial consortium SEMATECH, NIST has advanced measurement methods needed to identify the materials limits for the fabrication of 32 nm and smaller structures needed to continue advances in semiconductor device performance. Neutron reflectivity, near-edge x-ray absorption fine structure spectroscopy, and quartz crystal microbalance measurements have quantified critical parameters including photoacid diffusion and photoresist developer response.
- An upgrade to NIST Standard Reference Database 83 (NIST Structural Database) doubled the accessible data to more than 16,000 entries; and a prototype model for the dynamic linking of scientific databases (a critical step in future materials data technology) has been completed.
- To meet the need for reliable phase diagram data, NIST and the American Ceramic Society (ACerS) jointly published a series of critically evaluated collections of phase diagrams. Version 3.1 of NIST Standard Reference Database Number 31 (NIST/ACerS Phase Equilibria Diagrams) was issued to provide customers with comprehensive coverage of all diagrams and commentaries published to date, including Volume XIV published in 2005.
- The NIST Combinatorial Methods Center is pioneering the development of high-throughput measurement tools that speed the pace of innovation across the materials spectrum. Awarded the 2005 Department of Commerce Silver Medal for customer service, the Center has 18 participating member organizations, including Air Products, Dow Chemical, Intel, ExxonMobil, and Procter & Gamble. Through the Center, NIST has spawned innovative technologies for the rapid discovery and optimization of a wide array of products, including detergents, dental fillings, adhesives for advanced electronics, and contact lenses.
- Through its ongoing partnership with the American Dental Association (ADA), NIST technology has led to the development of a revolutionary toothpaste that is potentially more efficient in preventing cavities than fluoride toothpaste and that may help to repair enamel. This partnership with the ADA has lasted for 75 years and has resulted in countless advances in dentistry.
- A newly constructed spectroscopic microscope for three-dimensional chemical imaging of biological systems will enable the identification of live biological cells as well as the determination of their metabolism in real time, with no damage to the cells themselves.
- The lead-free work at NIST has shifted from solders to electroplated electronic component surface finishes. Tin whiskers that grow spontaneously from the lead-free finishes are causing a major product reliability issue, especially in the high reliability realm of aerospace, defense, and medical applications. Our major area of research is eliminating the fundamental causes of tin whisker growth, specifically by reducing the compressive stress and altering the columnar grain shape in electrodeposits. Also at the request of the International Electronics Manufacturing Initiative (iNEMI) members, a second area of research involves the development of a standard x-ray diffraction method to measure the stress in electroplated tin surface finishes.

- NIST has become a primary resource of metrological solutions for measurements of infrastructural materials under extreme loading conditions. NIST has ascertained critical properties for efficient use of fire-resistant steel; developed quick, accurate tests for measuring relevant high temperature properties; and provided data and standards development for fire-resistant steel.
- Data and models of materials behavior for both modern and past structural steels are being developed for strength, fire resistance, and high strain rate properties. This information will be made available in a form needed by those who develop models of the performance of buildings, bridges, and other vulnerable structures.
- Small-angle x-ray scattering (SAXS) for characterizing nanometer-scale structures in integrated circuits has been developed for SEMATECH. This technique will address a critical metrology need in the $200 billion semiconductor industry as the circuit dimensions in computer chips shrink below 50 nm. Unlike current optical techniques, which will become less accurate with smaller features, this x-ray technique will become more accurate as circuits get smaller.
- A suite of synchrotron-based x-ray measurement facilities spanning the entire periodic table of the elements is now available for the non-destructive chemical and structural optimization of materials, including state-of-the-art synchrotron-based depth profiling, sub-surface chemistry, and interface chemistry.
- Metrologies to determine the mechanisms underlying the transport properties of materials used in regenerative medicine applications have been demonstrated, and methods to discriminate between viable and non-viable cells for tissue engineering applications based on biomimetic gradient libraries and single-cell statistics have been demonstrated, as well.

NIST's FY 2008 base program operating objectives in materials science and engineering include the following:

- Work with other national and international organizations to standardize critical materials test procedures needed by industry to promote the acceptance of U.S. goods and services in the global marketplace, thereby improving the balance of trade.
- Develop experimental and computational techniques to measure the properties of polymer, ceramic, and metal thin films and electrical interconnects to be used by the U.S. microelectronics industry to design a new generation of electronic products more quickly and economically. New high-throughput combinatorial methods are being developed specifically to assist the electronics industry in identifying materials and manufacturing processes needed for nanotechnology applications.
- Develop materials measurement methods and standards required to bring advanced medical technologies to market quickly and efficiently. Specifically, derive the foundation for a measurement system that will speed the development and growth of the emerging tissue engineering industry, including standards, experimental protocols, and their validations from fundamental physical, biological, and engineering sciences.
- Develop unique instrumentation and measurement methods for materials chemistry and structure characterization to assist industry in identifying and implementing materials with improved performance for electronics, biotechnology, and homeland security

applications. NIST's Center for Synchrotron Measurement Science and Technology at Brookhaven National Laboratory's National Synchrotron Light Source (NSLS) enables materials innovations through the use of a new generation of advanced synchrotron tools, applies these tools through collaborative research, and makes these tools broadly accessible. NIST is a major partner in the National Synchrotron Light Source-II (NSLS-II) by leveraging and transferring advanced instrumentation and expertise from the NSLS to the NSLS-II. FY 2008 milestones include chemical and structural characterization of low atomic mass materials, such as polymers and carbon nanotubes, with sub-monolayer sensitivity and chemical bond selectivity; and determination of structure of medium to high atomic mass materials as a function of depth.

- Provide the industrial, scientific and technical communities access to evaluated data on crystallographic structure and phase equilibria, along with scientific software and methods to exploit such data by developing enhanced World-Wide-Web delivery systems in collaboration with external partners.
- Develop unique instrumentation, measurement techniques, and models for the determination of nanoscale properties of materials. Conduct international round-robin studies on measurement techniques and develop standards to facilitate trade and commerce related to micro and nanomaterials. Anticipated milestones include a robust set of mechanical testing machines for nanotechnology to quantify localized mechanical properties and behavior of nanoscale structures and interfaces.
- Develop the infrastructure and methodology for applying combinatorial methods to measurements of materials properties. Demonstrations of these techniques will facilitate rapid validation and utilization of the methodology to reduce time to market for new materials produced by U.S. industry. FY 2008 milestones include an integrated metrology platform for materials characterization comprised of modular microfluidic-based combinatorial experiments, and a metrology tool for assessing thermal processes in nanoscale systems for hydrogen storage, electronics and healthcare.
- Develop an integrated and interdisciplinary suite of metrologies to correlate the performance of next generation organic electronic devices with structure, properties, and chemistry of critical materials and interfaces. NIST will guide the development of standard test methods and provide the fundamental measurements needed to realize an exciting array of new devices and applications including printable large-area displays, wearable electronics, paper-like electronic newspapers, low-cost photovoltaic cells, ubiquitous integrated sensors and detectors, and low cost radio-frequency identification (RFID) tags.
- Develop metrology needed to correlate nanoscale materials properties with processing and performance by using nanoimprint lithography (NIL). Using the nanomanufacturing facilities of the Center for Nanoscale Science and Technology and the Advanced Measurement Laboratory, NIST will produce a variety of standard test structures with systematic variations in dimensions, structure, and molecular level materials properties needed to characterize the stability of robust advanced nanostructures.
- Develop unique in-situ instrumentation, measurement techniques, and models for the control of manufacturing processes used to fabricate nanostructure materials and devices reliably and reproducibly in a high volume, production environment. Anticipated

milestones include development of techniques to measure the nanoscale and wafer-scale stresses that develop during use of self-assembled monolayers and templating systems and of measurements and models of line-edge roughness in templated structures.

6) Building and Fire Research - Building construction in the United States is a mammoth-sized industry–$1.4 trillion in 2004 (almost 12 percent of the GDP), and employing between five and eight percent of the workforce–but the vast majority of construction firms are small and without the resources to conduct the sort of in-depth research needed to improve building practices. Fire protection and firefighting, largely handled by local communities, is similarly fragmented, and fire is a major problem in the United States, which has one of the worst fire fatality rates of the world's industrialized nations. Even with improvements in fire protection and safety, in 2004, 3,900 lives were lost in fires, 17,785 more were seriously injured, and direct property loss reached $10 billion. NIST's building and fire research program was established to meet the need for a continuing, high-quality research effort to support the construction and fire-safety communities – better buildings that are safer, built faster, at lower cost and higher quality, and that are less costly to operate and have less impact on the environment.

NIST's program in building and fire research has four main thrusts:

- High performance construction materials and systems to enable scientific and technology-based innovation to modernize and enhance the performance of construction materials and systems.
- Enhanced building performance to provide the means to assure buildings work better throughout their useful lives. Among other services, NIST maintains the national standard for measuring the R-value of thermal insulation and certifies state laboratories for testing both concrete and asphalt highway pavement.
- Fire loss reduction to enable engineered fire safety for people, products, and facilities, and enhance fire fighter effectiveness.
- Homeland security to enable the development and implementation of the standards, technology, and practices needed for cost-effective improvements to the safety and security of buildings, building occupants, and first responders, including evacuation, emergency response procedures, and threat mitigation.

NIST has a long record of assisting in the investigation and analysis of major building disasters. Its most recent high-profile investigation is an analysis of factors leading to the collapse of the WTC buildings after the September 11th terrorist attacks. In 2002, recognizing NIST's expertise, the National Construction Safety Team Act was enacted by Congress and signed into law by the President. The Act authorizes NIST to form a team to investigate building failures where there has been a substantial loss of life, or where there is the potential for a substantial loss of life. NIST also has other authorities under which it conducts building and fire safety investigations.

In recognition of NIST's expertise in building and fire safety, the Congress passed, and the President signed into law, the National Earthquake Hazards Reduction Program (NEHRP) Reauthorization Act of 2004, which transferred the lead agency function for this multi-agency program to NIST from the Federal Emergency Management Agency. NEHRP is the Federal government's long-term program to reduce U.S. earthquake risks to life and property. The statute assigned major new research and coordination responsibilities for the program to NIST. In addition, the National Windstorm Impact Reduction Act of 2004 authorizes NIST to support research and development to improve codes, standards, and practices for buildings, structures, and lifelines that will measurably reduce the loss of life and property from windstorms.

Typical NIST building and fire research projects recently completed included:

- Development of particle image velocimetry measurement technology that can be used to successfully determine the three-dimensional flow of smoke and gases in a doorway of a building fire. Quantifying this flow is an important step to understanding fire behavior. Detailed recommendations have been developed for others to use this technology in fire experiments.
- Development of automatic equipment information exchange technology for use in major construction projects. Mechanical equipment requirements can be converted to specifications which in turn allow automatic bidding from multiple suppliers and final selection by the project owner; all completed in minutes compared to weeks for the traditional process. This project was carried out in collaboration with an industry consortium with all major industrial firms participating.

NIST's FY 2008 base program operating objectives in building and fire research include the following:

- Develop a web site for evaluating disaster mitigation investments in constructed facilities that will serve as a central link to printed and electronic resources. Develop and use a training course for instructors to certify individuals to teach the basic ASTM-sanctioned workshop on cost-effective protection against natural and man-made hazards. Disseminate results through workshops in collaboration with ASTM, DHS, the Federal Facilities Council, GSA, and other agency partners.
- Develop novel metrology protocols for measuring the concentration of isocyanate bonded to carbon nanotubes. A high concentration of isocyanate is necessary to produce high performance, polyurethane nanocomposite products which can be used for a variety of construction and transportation infrastructure applications such as long lasting and fire-retardant paints and coatings.
- Complete version 8.0 of the Virtual Cement and Concrete Testing Laboratory (VCCTL) software based on the joint NIST/industry research completed during FY 2007 and distribute enhanced and documented version of the software for use by VCCTL industry consortium members. The predictive power of VCCTL 8.0 will allow end-users to optimize the hydration and physical properties of concretes made with any kind of cement and many different mineral admixtures, and will start replacing routine physical testing.

- Establish the National Center for 3D Imaging System Performance Evaluation and Calibration in collaboration with the Manufacturing Engineering Laboratory to meet a critical United States Measurement System need by implementing: (1) an indoor, artifact-based facility focused on the development of test protocols for the performance evaluation of 3D imaging systems and associated software and (2) an outdoor benchmark facility for testing long-range 3D imaging systems for the construction and transportation industries. This facility will help to accelerate the adoption of 3D imaging technology by providing the scientific basis and traceability upon which users of these systems can compare and evaluate potential instruments as well as provide end-users with quantitative measures of the delivered information.
- In collaboration with International Energy Agency partners, develop commissioning procedures, automated tools, and guidelines for use in commissioning advanced building systems in low-energy buildings. Reliable commissioning practices and tools to implement them are necessary to achieve national goals of reduced energy consumption in buildings while maintaining safe and comfortable conditions.
- Demonstrate interoperability of exemplar software applications that integrate HVAC equipment supply-chain transactions with building design and building commissioning. Achieving this interoperability is a major step in the reduction of cycle times in the supply chains of the U.S. building and construction industries.
- Develop guidance on the design of healthcare facilities, plus associated design tools and methodologies, for improved pressure and airflow control. This guidance will improve the ability to control the spread of airborne infection, thereby reducing the health and cost impacts of such disease transmission.
- Improve respiratory protection for first responders by developing modeling tools, experiments, and instrumentation to characterize the environments internal and external to a fire fighter's respiratory mask. This will allow simulation/measurement of the uptake of toxic gases and fine particulates from the surrounding environment in the presence of a leak.
- Generate a benchmark database of fire measurements from tests conducted within a full-scale standard room for multiple fuel types and fuel distributions. This database will provide insight into the mechanisms of production of hazardous gases and particles and enable the validation and guidance for further development of computational models to design buildings for fire safety.
- Develop the tools to characterize the interactions between nano-additive flame retardants and conventional flame retardants useful in producing low flammability foam for furniture and mattresses.

7) Computer Science and Applied Mathematics - The IT sector that encompasses computers, software, telecommunications products and services, Internet and online services, systems integration, and professional services companies, is one of the Nation's largest sectors, exceeding 14 percent of U.S. GDP[5] in 2005 and employing more than 10 million employees [6] in 2003. Access to the Internet in U.S. households has grown rapidly to 70 percent, with 95 percent of public schools with access.[7] E-commerce transactions reportedly surpassed $3.5 trillion[8] in 2004. Additionally, IT research and development expenditures matched revenue growth, accounting for 14.4 percent of all industry R&D. It is an industry that impacts the lives of virtually every American, every day. However, the growth of information technology has led to growing pains throughout a number of fields. For example, a recent NIST planning study estimated that inadequate software testing is costing the economy $60 billion per year, of which approximately $22 billion could be eliminated with an improved testing infrastructure. NIST collaborates with industry, consortia, and other Federal agencies to utilize its core competencies in IT measurement and testing, mathematical and statistical analysis for measurement science, modeling and simulation for measurement science, and IT standards development and deployment to resolve issues of growth throughout its fields of technical expertise including software, networking, cybersecurity, information access, mathematics and statistics. NIST works to make information technology, mathematics, and statistics more usable, more accessible, more reliable, and more secure.

NIST programs are guided by national priorities, including mandated activities, and broad IT industry drivers, including the globalization and pervasiveness of IT, the information explosion, the new fundamental technologies enabled by IT, and the inadequate reliability, quality, security, and trustworthiness of computing. Generally, NIST uses its core competencies and technical expertise as applied to these guides to develops tests, metrics, and tools to advance, accelerate, and expedite improvements in the interoperability, security, privacy, scalability, quality and uncertainty, and usability of common technologies. NIST has many important programs, including many that impact national security, such as the improvement of the accuracy and interoperability of biometrics recognition systems and the communications among first responders. NIST is also a focal point for developing and implementing computer security standards and procedures for the Federal civilian agencies that are also widely used in industry.

NIST works across the IT industry, industry consortia, and the Federal government while also participating in inter-agency planning activities such as the Federal Networking and Information Technology R&D Program (NITRD). NIST also provides leadership and collaborative research in the application of mathematics, statistics, and computers to science and engineering throughout the research community.

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[5] Information Technology Industry Council, United States Information Technology Industry Statistics 1960-2010 Report (Washington, DC 2005)
[6] "The world's most exciting and dynamic industry!", Center for Advanced Technology Careers, 1 April 2005, <http://www.ccri.edu/catc/industry.shtml>
[7] Information Technology Industry Council, United States Information Technology Industry Statistics 1960-2010 Report (Washington, DC 2005)
[8] "E-Commerce Statistics", EpayNews reporting Forrester Research data, 1 April 2005, <http://www.epaynews.com/statistics/>

Some specific examples of NIST's leadership in computer science and applied mathematics include:

- In response to the Federal Information Security Management Act, NIST published Federal Information Processing Standard Publication 200 (FIPS 200), the second of two mandatory security standards that requires all Federal agencies to develop, document, and implement agency-wide information security programs and to provide security for the information and information systems that support the operations and assets of the agencies.
- The Common Industry Format (CIF) for Usability Test Reports, developed jointly by NIST and industry, was approved as an international standard by the International Organization for Standardization (ISO). CIF provides a format for describing usability testing of a product, including the experimental design of the tests, tasks to be performed, test participants, data collection methods, and usability measures (such as objective measures of effectiveness, efficiency, and the amount of effort for learning how to use the product successfully). The purpose of the CIF is to encourage incorporation of usability as an element in decision making for software procurement.
- NIST conducted a two-day policy-to-practice workshop on emerging Domain Name System Security (DNSSEC) standards and technologies. The Domain Name System (DNS) is a globally distributed database that provides two-way mappings between names (e.g., www.nist.gov) and Internet Protocol (IP) addresses (e.g., 129.6.13.23). Practically all Internet communications are initiated with a DNS request to resolve a name to an IP address. Although arguably one of the most critical components of the Internet's core infrastructure, the current operational DNS is vulnerable to malicious attack.
- NIST developed unique measurement capabilities for immersive visualization environments, tools that allow the user to interactively measure linear distances in a 3D scene, to manage sets of such measurements, and to perform interactive analyses from within the environment. These capabilities will be extremely useful for scientific discovery through exploration of 3D data obtained from physical measurement systems.
- NIST developed tools to automatically and dynamically generate software tests. These tools enable automatic test generation in test suites that accommodate variations in software environments and accumulating layers of specification.
- NIST continued to provide essential testing and recommendations to enhance the security of our borders and government facilities through robust biometrics technologies. NIST tested Software Development Kits and wrote a document on performance for the US VISIT IDENT system, a primary fingerprint matcher. Further, NIST completed biometric specifications for the Federal government Personal Identity Verification Cards.

NIST's FY 2008 base program operating objectives in computer science and applied mathematics include the following:

- Develop metrics and measurement techniques for characterizing known and unknown cyber security vulnerabilities. Together, with tools to predict expected behavior, these methodologies will provide mechanisms to assign security confidence levels, measure improvements in the overall security of a system, and identify and mitigate would be attackers.

- Develop tests, metrics, and tools, to evaluate human-computer interaction and technologies for accessing digital multimedia and other complex information (including web pages, video, voice, text, audio, and graphics), as well as for accessing multi-media content in smart workspaces.
- Develop and evaluate technologies for context-aware applications on wireless handheld devices that manage the transport, processing, and display of information in an intelligent networking environment, with special focus on applications in healthcare and emergency-response situations.
- Collaborate with industry to develop network protection and restoration techniques, and to improve the robustness of emerging Internet core switching technologies to expedite the development of new Internet and optical network infrastructure protection technologies.
- Evaluate multimodal biometrics, including iris, fingerprint, and facial images while improving the accuracy and interoperability for use in biometric recognition to enhance the real-time verification and identification of those seeking to enter the United States.
- Develop mathematical, statistical, and computational methods, tools, and software, specialized for materials and processes operating at all physical levels, including nanoscale, to support research and enable industrial implementation.
- Develop, publish, and disseminate fundamental methodologies for statistical metrology and computation that support NIST's participation in national and international standards organizations and industry consortia.
- Provide the measurements and standards to ensure interoperability and security of the systems and components underlying new technologies, particularly large-scale scientific systems.

8) Standards and Technology Services - For research advances of the NIST Laboratories to be most useful, the results must reach the intended users. NIST enables U.S. industry to develop competitive technologies by providing U.S. industry with central access to standard reference materials, standard reference data, calibrations, and laboratory accreditation, and thereby traceability to national and international standards of measurement. These NIST services meet industry needs for accurate measurements and measurement traceability to ensure product quality, production efficiency, parts interchangeability, conformance to specifications, and performance suitability. NIST programs also provide a central source of information and leadership for U.S. industry regarding national and international standardization and conformity assessment activities, including product testing and certification. Domestically, NIST provides the technical underpinning for the U.S. commercial metrology system, through the development and dissemination of handbooks, guidance, documents and recommendations, focused training, and technical support for laboratory metrology.

NIST provides unbiased evaluation and recognition of laboratory performance through the National Voluntary Laboratory Accreditation Program. These accredited laboratories play an important role in conformity assurance for commerce and regulatory purposes, as well as in support of international trade. By working with industry, state and local weights and measures officials, other

Federal agencies, retailers, consumer groups, the National Conference on Weights and Measures, and the International Organization of Legal Metrology (OIML), NIST helps to establish uniform and accurate legal metrology standards used in national and international trade. NIST also coordinates metric transition activities throughout the Federal government and initiates actions to remove regulatory barriers to the use of the metric system to increase the competitiveness of U.S. industry in the global market. NIST promotes efficiency in the U.S. documentary standards and conformity assessment systems by carrying out its statutory role of coordinating the use by Federal agencies of private-sector standards, and coordinating Federal, State, and local technical standards and conformity assessment activities with those of the private sector. NIST also conducts programs to enhance the flow of standards information to U.S. industry, promote foreign adoption of U.S. standards and technology, and align U.S. standards with international standards.

Typical examples of NIST's work to ease regulatory barriers to U.S. exporters include:

- Working with industrial laboratories to ensure hassle-free exports of telecommunications equipment. NIST is the U.S. authority empowered under the Asia-Pacific Economic Cooperation (APEC) Telecommunications Equipment Mutual Recognition Arrangement (MRA), the U.S.-European Free Trade Area (EFTA) and U.S.-European Union (EU) Mutual Recognition Agreement, to designate qualifying U.S. organizations as competent to certify U.S. telecommunications equipment (as meeting foreign regulatory requirements) for direct export to APEC and European countries. Currently, 75 organizations are qualified to test and certify telecommunications and IT equipment under MRAs covering the EU and EFTA markets and six APEC markets (Australia, Canada, Chinese Taipei, Hong Kong, Singapore and the Republic of Korea). The value of U.S. exports is $12.5 billion to European markets and $22.9 billion to APEC markets. The ability of U.S. exporters to test and certify equipment at the point of manufacture accelerates time to market for PCs and peripherals, radio transmitters, satellite terminal equipment and telecommunications terminal equipment, reducing burdens on suppliers and regulatory authorities while ensuring product compliance.
- Leading the effort to develop the process to align U.S. and international legal metrology standards to ensure acceptance of U.S. technology and instrumentation for scales and meters, medical measuring instruments, and pollution, radiation, and law enforcement measurement instruments, both domestically and internationally. Legal metrology impacts approximately 50 percent of the U.S. GDP, which in March of 2006 was $12.1 trillion.
- Working with U.S. industry to promote greater market access for U.S. exports by informing key foreign technical experts, policy makers and regulators about the strengths of the U.S. standards and conformity assessment system in ensuring that U.S. exports adequately meet standards for performance and safety, through the Standards in Trade Workshop program. Experts from approximately 70 countries have participated in workshops covering major export sectors such as medical devices, IT and telecommunications equipment, automotive and electrical equipment, and have formed a network of key contacts for U.S. exporters in target, high impact markets.

NIST's FY 2008 base program operating objectives in standards and technology services include the following:

- Deliver calibration services, standard reference materials, and standard reference data to provide industry, government, and the public with accurate physical, chemical, and engineering measurements. Design a seamless business process interface to these NIST services.
- Coordinate with the International Committee on Weights and Measures under the Meter Convention, to establish a worldwide system of uniform and accurate measurement standards to support U.S. exports.
- Work with the National Cooperation for Laboratory Accreditation (NACLA) and the International Laboratory Accreditation Cooperation (ILAC), to develop and maintain compatible systems, at both the national and international levels, for recognizing competent laboratory accreditation bodies to accredit calibration and testing laboratories when the services of such laboratories are required to meet private and public-sector needs, and to support U.S. exports.
- Support the statutory goal of increasing government agency use of private-sector standards by providing Federal agencies with the necessary tools to estimate the quantitative benefits of the use of voluntary consensus standards in regulatory, procurement, and other actions; as well as a comprehensive information portal, which provides agencies, businesses, and other organizations–as well as interested citizens–with information and web links on the use of standards by government agencies.
- Identify and address opportunities to reduce unnecessary duplication in conformity assessment programs within Federal agencies, encouraging agencies to consolidate duplicative programs and to rely on competent private sector programs where feasible.
- Enhance information services, including web tools, provided through the National Center for Standards and Certification Information and the U.S. Inquiry Point for the World Trade Organization to improve dissemination to U.S. businesses of market intelligence and information on standards developments in priority foreign markets that might significantly impact trade.
- Advance U.S. business and trade interests by providing standards and conformity assessment expertise to identify and address technical barriers to trade affecting U.S. exporters, and by providing training for regulatory and trade officials from developing countries on the proper use of documentary standards in trade, conformity assurance, product certification, accreditation of calibration and testing laboratories, and physical and chemical metrology.
- Conduct analyses of the economic impact of standards and standards-related activities on innovation and competitiveness, providing the necessary data to support identification of priority areas for future activities.
- Improve the national infrastructure for advanced legal metrology by providing laboratory metrology training, conducting proficiency testing to ensure accurate measurements, and promoting the documentation and use of quality system practices in conformity with international standards and guidelines for testing and calibration laboratories.

- Coordinate with state and local weights and measures officials, industry, and Federal agencies, to provide uniform and accurate measurements for retail and wholesale trade throughout the United States and align U.S. and international legal metrology standards through uniform legal metrology requirements, test methods, training, reference materials, and manuals to facilitate exports and assure a fair market for U.S. consumers and businesses that affects about $6 trillion of retail and wholesale trade.
- Improve and strengthen state and local weights and measures programs in response to changing market forces and practices to redirect resources to improve efficiency and effectiveness. Redirect and expand the use of industry/regulatory working groups as a key resource to develop solutions to technical and marketing issues of national and international legal metrology issues.

The four centrally-managed programs that provide support to all NIST programs include:

1) Innovations in Measurement Science Program - NIST must maintain the capacity to contribute effectively to future national needs and goals. This program provides funding for high priority fundamental research to build new capabilities necessary to develop and maintain state-of-the-art knowledge in areas of science and engineering related to measurement techniques and fundamental data. The capacity to respond is based on the availability of teams of scientists and engineers, working at the forefront of research in various areas related to future advanced technologies, who have the ability to devote their efforts to specific, new problems as they arise. Projects previously undertaken in this program have resulted in focused areas for new program development.

The FY 2008 base program operating objectives for the Innovations in Measurement Science Program include the following:

- Select and initiate several new projects through a competitive review process. Selected projects continue to be supported for a maximum of five years.

Build NIST's research capabilities and technical readiness to address state-of-the-art measurements and standards opportunities and needs.

2) Postdoctoral Research Associates Program - NIST supports a nationally competitive Postdoctoral Research Associates Program, which is administered in cooperation with the National Academy of Sciences/National Research Council (NRC). The Postdoctoral program recruits outstanding research scientists and engineers to work on NIST research projects, strengthens communications with university researchers, and provides a valuable mechanism for the transfer of research results from NIST to the scientific and engineering communities.

The FY 2008 base program operating objectives for the Postdoctoral Research Associates Program include the following:

- Select postdoctoral scientists and engineers of exceptional promise and ability for two-year appointments to perform advanced research related to the NIST mission.
- Introduce the latest university research results and techniques to NIST scientific programs and share NIST's unique research capabilities with the U.S. scientific and engineering communities.

3) Computer Support - The central support for scientific computing program provides secure, centrally-managed IT infrastructure resources supporting NIST's technical mission leading to improved measurement methods, standards advances, reference data, and research results benefiting numerous sectors of the U.S. economy. The scope of the program includes: deploying and managing new secure, high-performance networking and computing resources; providing computer facilities meeting Federal information technology security requirements, as well as the specialized requirements of the equipment located at NIST; and providing secure, distributed, redundant storage for NIST data.

These resources enable NIST laboratories and programs to implement computational platforms supporting research-specific needs, dissemination of NIST results to the public, and collaborations with NIST partners.

The FY 2008 base program operating objectives for Computer Support include the following:

- Manage the IT infrastructure including computing systems, associated communications, mass storage, networking, and software capabilities to support all NIST programs; and
- Optimize the mix of computing platforms, online data storage, backup and archival storage, network interconnects, system security mechanisms, and application software packages to meet NIST users' mission-specific requirements.

4) Business Systems - This program provides the necessary resources to operate and maintain administrative and financial management systems at NIST that satisfy the requirements established by the Department of Commerce (DoC), the Office of Management and Budget, the Government Accountability Office, the Department of Treasury, the General Services Administration, and the Congress.

The Department and the Administration have undertaken major modernization initiatives of various business systems, functions, and processes. DoC envisions common, Department-wide, user-friendly, and flexible systems to support financial management, procurement management, travel management, grants management, property management, and other administrative functions. New business systems or upgrades to existing systems will be implemented over the next several years. Any new systems acquired will be

integrated with the Department's Commerce Business System (CBS). They will also interface with other internal and external administrative and management systems. NIST's business systems are an integral part of the vision for the administrative and financial management systems formulated by the DoC.

The FY 2008 base program operating objectives for Business Systems include:

- Implement, operate, and maintain administrative management systems that support the delivery of administrative services to NIST and its cross-service customers; and
- Operate and maintain CBS and the NIST CBS Portal that supports delivery of services to NIST and its cross-service customers.

Performance Measures

Data on NIST programmatic performance evaluation and reporting are provided in Exhibit 3A of this budget request.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Laboratories and Technical Programs
REIMBURSABLE PROGRAM AND WORKING CAPITAL FUND INVESTMENTS
(Dollar amounts in thousands)

	FY 2006 Actual	FY 2007 Continuing Resolution	FY 2008 Estimate
Department of Defense			
Air Force	$8,474	$9,780	$6,742
Army	2,456	2,340	1,928
Navy	2,053	1,602	1,545
Other	17,840	19,087	14,405
Subtotal, Department of Defense	30,823	32,809	24,620
Department of Agriculture	5	0	0
Department of Commerce	11,332	9,579	9,339
Department of Energy	4,075	4,614	3,372
Department of Health & Human Services	5,167	7,815	3,536
Department of Homeland Security	42,371	33,027	27,579
Department of Housing & Urban Development	565	600	600
Department of the Interior	110	153	145
Department of Justice	11,191	17,609	16,466
Department of State	926	1,104	901
Department of Transportation	2,162	2,357	1,538
Department of the Treasury	206	93	18
Department of Veterans Affairs	144	140	0
Environmental Protection Agency	1,454	975	920
General Services Administration	1,024	1,590	267
National Aeronautics & Space Administration	4,603	3,452	3,316
National Science Foundation	694	417	266
Nuclear Regulatory Commission	342	250	265
Other	1,907	1,784	1,152
Subtotal, Federal Agencies	119,101	118,368	94,300
Calibrations & Testing	8,889	8,244	8,339
Technical & Advisory Services	24,793	21,044	20,445
Standard Reference Materials	14,669	8,802	8,778
Subtotal, Other Reimbursables	48,351	38,090	37,562
Total, Reimbursable Program	167,452	156,458	131,862
Equipment Transfers	1,050	200	7,950
Subtotal, WCF transfer	1,050	200	7,950
Equipment Investments	19,315	19,132	18,496
IE Amortization	(17,467)	(16,731)	(18,496)
WCF Operating Adjustments	12,054	0	0
Total, WCF Investments	13,902	2,401	0
Total, Reimbursable Program and WCF Investments	182,403	159,059	139,812

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: NIST laboratories
Subactivity: National research facilities

Line Item		2006 Estimate Personnel	2006 Estimate Amount	2007 Continuing Resolution Personnel	2007 Continuing Resolution Amount	2008 Base Personnel	2008 Base Amount	2008 Estimate Personnel	2008 Estimate Amount	Increase/ (Decrease) Over 2008 Base Personnel	Increase/ (Decrease) Over 2008 Base Amount
NIST center for neutron research	Pos./Approp	111	$28,247	106	$28,516	118	$39,149	118	$39,149	0	0
	FTE/Obl.	118	28,329	128	28,229	137	38,828	137	38,828	0	0
Center for nanoscale science and technology	Pos./Approp	14	11,295	22	11,560	68	33,277	83	39,277	15	$6,000
	FTE/Obl.	9	10,807	22	11,911	56	30,292	67	35,292	11	5,000
Total	Pos./Approp	125	39,542	128	40,076	186	72,426	201	78,426	15	6,000
	FTE/Obl.	127	39,136	150	40,140	193	69,120	204	74,120	11	5,000

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: NIST laboratories
Subactivity: National research facilities

Line Item	2006 Actual FTE	2006 Actual Amount	2007 Continuing Resolution FTE	2007 Continuing Resolution Amount	2008 Base FTE	2008 Base Amount	2008 Estimate FTE	2008 Estimate Amount	Increase/ (Decrease) Over 2008 Base FTE	Increase/ (Decrease) Over 2008 Base Amount
NIST center for neutron research										
WCF transfer		0		$550		$550		$550		0
Reimbursables	14	$3,939	15	5,159	15	5,260	15	5,260	0	0
WCF investments	0	91	0	(448)	0	0	0	0	0	0
Total	14	4,030	15	5,261	15	5,810	15	5,810	0	0
Center for nanoscale science and technology										
WCF transfer		250		0		3,000		4,000		$1,000
Reimbursables	0	0	0	230	0	230	0	230	0	0
WCF investments	0	(142)	0	28	0	0	0	0	0	0
Total	0	108	0	258	0	3,230	0	4,230	0	1,000
Total										
WCF transfer		250		550		3,550		4,550		1,000
Reimbursables	14	3,939	15	5,389	15	5,490	15	5,490	0	0
WCF investments	0	(51)	0	(420)	0	0	0	0	0	0
Total	14	4,138	15	5,519	15	9,040	15	10,040	0	1,000

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
NATIONAL RESEARCH FACILITIES

Goal Statement

This subactivity supports the NIST goal to promote innovation, facilitate trade, and ensure public safety and security by strengthening the Nation's measurement and standards infrastructure. This subactivity also supports the Department of Commerce strategic goal to promote U.S. innovation and industrial competitiveness by protecting intellectual property, enhancing technical standards, and advancing measurement science.

Base Program

This subactivity includes two major NIST research facilities: the NIST Center for Neutron Research (NCNR) and the Center for Nanoscale Science and Technology (CNST).

The NCNR is the Nation's premier neutron research facility. It is a major national user facility that serves the majority of all neutron scattering users in the United States. The facility provides an intense source of neutron beams that are used to probe the molecular and atomic structures and dynamics of a wide range of materials. The NCNR also boasts a unique, large-volume, liquid hydrogen *cold source*, which produces the highest intensity of "cold" (or low-energy) neutron beams in the country. Cold neutrons allow neutron scattering techniques to probe the large structures and slow dynamics in advanced materials such as plastics, magnetic films, chemical catalysts, biological materials, and composites. With state-of-the-art measurement capabilities unavailable elsewhere in North America, the NCNR plays an essential role in broad sectors of nano-science and technology. In breadth of applications, neutron beam measurement techniques are on a par with the x-ray or microscope in their ability to probe materials that are the focus of study in today's most important research areas, including materials technology, biotechnology, and nanotechnology.

The NCNR operates as a national user facility with open, merit-based access to all qualified researchers. Use of the NCNR facilities for proprietary research is possible on a full-cost recovery basis. As a result, researchers from industry, academia, and other Federal

agencies depend on NIST's unique research capabilities to work on cutting edge science. The capabilities of this leading facility are further leveraged through a variety of cost-sharing partnerships with other agencies, industries, and universities to expand specific measurement capabilities, and to broaden the access to unique neutron instrumentation. The NCNR is significantly expanding its collaboration with the Nation's industrial and academic researchers with new instrumentation and analysis methods for macromolecular dynamics, neutron trace analysis, neutron chemical spectroscopy, neutron imaging, and neutron spectroscopy.

It would be difficult to overstate the importance of the NCNR to the Nation's research community. The NCNR was cited by a 2002 working group of the White House Office of Science and Technology Policy as "the highest performing and most used neutron facility in the United States" and was identified as a top priority for investments aimed to expand capability and access by U.S. researchers. The facility is also widely recognized as the most efficient and cost-effectively operated facility of its type in the world. Even allowing for new neutron sources now being developed, the NCNR is expected to remain the leading U.S. facility for meeting national neutron research needs for at least a decade.

In FY 2006, more than 2,100 researchers directly benefited from access to NCNR capabilities, which accounts for over two-thirds of all neutron research done in the United States last year. Included in this total are researchers from 41 U.S. states, Puerto Rico, and the District of Columbia; and representing 132 U.S. universities, over 45 U.S. corporations, and more than 35 U.S. government laboratories. Research performed at the NCNR resulted in approximately 310 publications in FY 2005. With a significant fraction of these papers published in the leading journals, the NCNR ranks as one of the highest impact neutron facilities in the world.

The FY 2008 NCNR base program operating objectives include the following:

- Expanding capability to world leading neutron measurement capability. This includes development of new instrumentation, cold source technology and neutron guide systems to enable a 30 percent expansion of cold neutron measurement at NIST when completed.
- Studying the structure and behavior of new materials at the nano-scale, making it possible to improve process technologies and develop new materials applications in areas ranging from lighter weight composites for the auto industry to improved semiconductor coatings for the electronics industry.
- Imaging the interior of complex devices and materials to non-destructively "see" how they function under various operating conditions. NCNR neutron imaging has made it possible to look through the steel casings of operating fuel cells and watch the flow and movement of water molecules as the cell functions, leading to better designs and performance.

- Studying the structure and motions of very large biological molecules such as proteins. Neutrons can see how they bend and fold–properties essential to protein function–and the insights gained could lead to the development of new drug therapies, new anti-toxins, and improved vaccines.
- Studying chemical interactions with porous or other complex structured materials. The unparalleled penetration and imaging power of neutrons is being used to develop new, more efficient, industrial catalysts and better ways to remove toxins from the environment, as well as to achieve a better understanding of complex biological systems at the cellular level.
- Probing the internal stresses in materials such as turbine blades, railroad rails, and shock absorbers, which are essential to understanding the performance of products used in industry, transportation, and defense.
- Developing ultra-high sensitivity detection methods for trace levels of chemicals. The NCNR leads the world in performing the most accurate neutron trace analysis, which has made it possible to track environmental pollutants in marine animals, to develop more accurate methods to detect arsenic in drinking water, and to detect potential explosives and other terrorist materials.

The Center for Nanoscale Science and Technology Recent appropriations are enabling NIST to make substantial progress in developing the CNST, a leading national center for collaborative research in nanoscale measurement. The CNST is dedicated to providing U.S. industry with the ability to succeed in the global quest to deliver new products using the unique opportunities for innovation afforded by nanotechnology. The CNST includes a research division and a nanofabrication and measurement facility–the Nanofab. The CNST has strong linkages to the discipline-oriented NIST Laboratories and the NCNR, affording its many partners unique opportunities to use the rich portfolio of measurement solutions and expertise available at the Nation's premier measurement science laboratory. Located in NIST's Advanced Measurement Laboratory (AML), the CNST benefits greatly from the stringent environmental controls on temperature, humidity, vibration, electrical, and magnetic fields. These are critical to CNST developing and maintaining world-leading capabilities at NIST that can produce accurate measurements down to the scale of individual atoms.

The CNST operates as a national collaborative user center where researchers from industry, academia, and other Federal laboratories can participate in solving critical measurement and fabrication issues in this extraordinarily dynamic and productive field of nanotechnology. Commercialization of nanotechnology involves measurement in a significant way at every stage of development, from discovery to manufacture. By collaborating with industry, academia, and other government agencies, the CNST endeavors to remove the existing measurement barriers to innovation. It does so through its carefully chosen research program and by sharing critical measurement and fabrication tools–many of which are not available elsewhere in the United States–with colleagues and partners. NIST is developing strategic alliances with universities, manufacturers, government laboratories and other partners to leverage its work in the CNST.

The FY 2008 CNST base program operating objectives include the following:

- Further expand access to the exceptional nanometrology and nanofabrication capabilities of NIST's AML via the CNST and the Nanofab to enable new researchers from industry, academia, and other Federal laboratories to use the facility and open new research opportunities into a broad range of scientific, engineering, and technological fields.
- Develop new ways to characterize and, thereby, improve the performance and reliability of nanostructured materials and devices. This will advance both the development of U.S. nanoproducts and their manufacture, affecting a wide variety of applications in transportation, housing, defense, medicine, agriculture, and homeland security.
- Develop a variety of new forms of nanofabrication and extend current methods to create industrial standards and, consequently, maintain the U.S. leadership position in nanotechnology.
- Broaden the scope of our nanometrology problem solving effort to include nanodevices that incorporate optical or magnetic components to facilitate advances in communications and information technology that promise to transform our lives.
- Help educate the new generation of nanotechnologist by providing young scientists and engineers with the ability to use some of the world's most advanced instrumentation to address the challenge of measuring the subtleties of nature that occur only on the atomic scale.

Performance Measures

Data on NIST programmatic performance evaluation and reporting are provided in Exhibit 3A of this budget request.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
National Research Facilities
REIMBURSABLE PROGRAM AND WORKING CAPITAL FUND INVESTMENTS
(Dollar amounts in thousands)

	FY 2006 Actual	FY 2007 Continuing Resolution	FY 2008 Estimate
Department of Defense			
Navy	0	$200	$200
Subtotal, Department of Defense	0	200	200
Department of Energy	$436	446	455
Department of Health & Human Services	72	117	119
Department of Transportation	27	0	0
National Science Foundation	2,729	3,918	3,996
Subtotal, Federal Agencies	3,264	4,681	4,770
Technical & Advisory Services	675	708	720
Subtotal, Other Reimbursables	675	708	720
Total, Reimbursable Program	3,939	5,389	5,490
Equipment Transfers	250	0	4,000
Reactor Fuel Transfers	0	550	550
Subtotal, WCF transfer	250	550	4,550
Equipment Investments	37	410	440
IE Amortization	(88)	(830)	(440)
Total, WCF Investments	(51)	(420)	0
Total, Reimbursable Program and WCF Investments	4,138	5,519	10,040

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Baldrige national quality program
Subactivity: Baldrige national quality program

		2006 Estimate		2007 Continuing Resolution		2008 Base		2008 Estimate		Increase/ (Decrease) Over 2008 Base	
Line Item		Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount
Baldrige national quality program	Pos./Approp	45	$7,291	44	$7,863	44	$8,094	44	$8,094	0	0
	FTE/Obl.	44	7,068	52	8,314	52	8,118	52	8,118	0	0

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Baldrige national quality program
Subactivity: Baldrige national quality program

Line Item	2006 Actual FTE	2006 Actual Amount	2007 Continuing Resolution FTE	2007 Continuing Resolution Amount	2008 Base FTE	2008 Base Amount	2008 Estimate FTE	2008 Estimate Amount	Increase/ (Decrease) Over 2008 Base FTE	Increase/ (Decrease) Over 2008 Base Amount
Baldrige national quality program										
WCF transfer		0		0		0		0		0
Reimbursables	0	$2,809	0	$3,064	0	$3,400	0	$3,400	0	0
WCF investments	0	(12)	0	4	0	0	0	0	0	0
Total	0	2,797	0	3,068	0	3,400	0	3,400	0	0

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
BALDRIGE NATIONAL QUALITY PROGRAM

Goal Statement

This program supports NIST's mission of promoting U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life. This program also supports the Department of Commerce (DoC) strategic goal to promote U.S. innovation and industrial competitiveness by protecting intellectual property, enhancing technical standards, and advancing measurement science. This program's goal is to assist U.S. businesses and other organizations in continuously improving their productivity, efficiency, and customer satisfaction by adopting performance improvement practices.

Base Program

The program has as its foundation the Malcolm Baldrige National Quality Award (MBNQA), created by P.L. 100-107 in August 1987. In 1999, the award was expanded to include categories in education and health care as authorized by the Technology Administration Act of 1998 (P.L. 105-309). In October 2004, Congress authorized the expansion of the award to include all nonprofit organizations, including Federal, state, and local governments (P.L. 108-320); $1.5 million was appropriated in fiscal year 2006 to support this expansion. The program conducted a pilot program for the nonprofit category in fiscal year 2006 and launched the full category in fiscal year 2007. The program has become a focal point for strengthening America's competitive position. The Baldrige Award has proven to be highly effective in stimulating interest in performance improvement, performance excellence, sharing and cooperation, and creation of new information networks within the business community and public benefit sectors. With the program's expansion to the nonprofit sector, all American organizations are now able to receive these benefits.

NIST responsibilities under P.L. 100-107, P.L. 105-309, and P.L. 108-320 are carried out by the Baldrige National Quality Program (BNQP). The program continues to build key linkages with other organizations and provide limited educational outreach services. U.S. businesses and non-profit organizations throughout the country are now turning to NIST for leadership in performance improvement. The

BNQP aims to improve its leadership as a focal point and educational resource for all U.S. organizations interested in improving their competitiveness and overall performance.

The Program's design and operational strategy is three-fold: 1) to create a standard for performance excellence that fosters communications and sharing among organizations of all types (e.g., business, education, health care, and nonprofit); 2) to build networks and other key linkages with external organizations to deliver performance, quality, and promote competitiveness throughout the United States; and 3) to build on the success of the present program by sharing lessons learned in the business, education, health care, and nonprofit communities with other sectors of the economy, thereby accelerating the process of performance improvement for those sectors.

The FY 2008 base program operating objectives include the following:

- Implement the MBNQA competition, including examiner selection, examiner training, and application review, to provide services to applicants in business, education, health care, and nonprofit categories;
- Conduct the Quest for Excellence Conference and Baldrige Regional Conferences where MBNQA recipients share their performance excellence strategies;
- Strengthen collaboration and information sharing with state and local quality award programs;
- Facilitate information sharing among all sectors of the U.S. economy through partnerships with key business, educational, health care, and nonprofit organizations; and
- Use e-technology to provide services to Baldrige stakeholders while maintaining confidentiality and security of stakeholder information.

Performance Measures

The BNQP evaluates its performance through a combination of methods, including independent expert review of all aspects of the program's plans and operations by its Board of Overseers and output measures focused on the program's key objectives of improving applicant satisfaction, increasing participation in the MBNQA, and promoting the growth of quality awareness and performance excellence throughout the United States.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Baldrige National Quality Program
REIMBURSABLE PROGRAM AND WORKING CAPITAL FUND INVESTMENTS
(Dollar amounts in thousands)

	FY 2006 Actual	FY 2007 Continuing Resolution	FY 2008 Estimate
Technical & Advisory Services	$2,809	$3,064	$3,400
Subtotal, Other Reimbursables	2,809	3,064	3,400
Total, Reimbursable Program	2,809	3,064	3,400
Equipment Investments	30	31	30
IE Amortization	(42)	(27)	(30)
Total, WCF Investments	(12)	4	0
Total, Reimbursable Program and WCF Investments	2,797	3,068	3,400

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
SUMMARY OF REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

	Object Class	2006 Actual	2007 Continuing Resolution	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
11	Personnel compensation					
11.1	Full-time permanent	$145,134	$156,393	$173,694	$177,365	$3,671
11.3	Other than full-time permanent	11,493	12,043	12,497	12,497	0
11.5	Other personnel compensation	5,355	5,355	5,355	5,355	0
11.9	Total personnel compensation	161,982	173,791	191,546	195,217	3,671
12.1	Civilian personnel benefits	41,501	45,858	51,270	52,256	986
13	Benefits for former personnel	126	126	126	126	0
21	Travel and transportation of persons	8,871	8,666	10,032	10,618	586
22	Transportation of things	1,061	1,051	1,586	1,731	145
23.1	Rental payments to GSA	15	4	0	0	0
23.2	Rental payments to others	3,178	1,753	1,248	1,248	0
23.3	Communications, utilities, and miscellaneous charges	26,182	27,335	30,999	32,220	1,221
24	Printing and reproduction	321	330	512	583	71
25.1	Advisory and assistance services	2,178	1,864	454	454	0
25.2	Other services	42,168	42,276	43,310	47,221	3,911
25.3	Purchases of goods and services from Government accounts	11,902	11,855	20,036	22,330	2,294
25.5	Research and development contracts	1,123	1,139	8,958	13,703	4,745
25.7	Operation and maintenance of equipment	11,008	10,821	12,731	13,123	392
26	Supplies and materials	21,970	21,790	25,222	27,000	1,778
31	Equipment	27,192	28,362	36,407	37,557	1,150
32	Land and structures	7	7	7	7	0
41	Grants, subsidies, and contributions	37,829	25,941	34,816	36,866	2,050
42	Insurance claims and indemnities	0	0	0	0	0
43	Interest and dividends	7	7	7	7	0
99	Total Obligations	398,621	402,976	469,267	492,267	23,000

	Object Class	2006 Actual	2007 Continuing Resolution	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
99	Total Obligations	398,621	402,976	469,267	492,267	23,000
	Less Prior Year Recoveries	(2,097)	(1,000)	(1,000)	(1,000)	0
	Less Prior Year Unobligated Balance	(5,192)	(4,898)	0	0	0
	Plus Unobligated Balance, End of Year	4,898	0			
	Plus Expired Balance from EAC Transfer	4				
	Total Budget Authority	396,234	397,078	468,267	491,267	23,000
	Unobligated Balance Rescission					
	Transfer to NIST Working Capital Fund	1,300	750	10,000	12,500	2,500
	Transfer from Election Assistance Commission	(2,772)	(2,772)	0	(3,250)	(3,250)
	Total Requirements	394,762	395,056	478,267	500,517	22,250

Personnel Data

Full-time equivalent employment:					
Full-time permanent	1,557	1,637	1,761	1,803	42
Other than full-time permanent	217	217	217	217	0
Total	1,774	1,854	1,978	2,020	42
Authorized Positions:					
Full-time permanent	1,792	1,732	1,898	1,954	56
Other than full-time permanent	52	52	52	52	0
Total	1,844	1,784	1,950	2,006	56

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
DETAILED REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

Object Class	2008 Adjustments to Base	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
11 Personnel compensation				
11.1 Full-time permanent				
Executive level	$1	$147	$147	0
Senior executive service	113	2,852	2,852	0
Career path	5,472	160,683	164,354	$3,671
Wage board	222	6,280	6,280	0
Scientific & professional (P.L. 80-313)	127	3,732	3,732	0
Subtotal	5,935	173,694	177,365	3,671
11.3 Other than full-time permanent				
Career path	442	12,371	12,371	0
Wage board	12	95	95	0
Scientific & professional (P.L. 80-313)	0	0	0	0
Experts & consultants	0	31	31	0
	0	0	0	0
Subtotal	454	12,497	12,497	0
11.5 Other personnel compensation				
Overtime	0	1,183	1,183	0
SES performance awards	0	173	173	0
Cash awards	0	3,776	3,776	0
Other	0	223	223	0
Subtotal	0	5,355	5,355	0
11.9 Total personnel compensation	6,389	191,546	195,217	3,671

Object Class	2008 Adjustments to Base	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
12.1 Civilian personnel benefits				
Civil service retirement	0	2,400	2,400	0
Federal employees' retirement	904	17,405	17,817	412
Thrift savings plan	0	5,804	5,877	73
Federal Insurance Contribution Act	570	11,097	11,379	282
Health insurance	830	12,318	12,532	214
Life insurance	12	284	289	5
Employees' Compensation Fund	0	545	545	0
Other	69	1,417	1,417	0
Subtotal	2,385	51,270	52,256	986
13 Benefits for former personnel				
Severance pay	0	112	112	0
Unemployment compensation	0	14	14	0
Other	0	0	0	0
Subtotal	0	126	126	0
21 Travel and transportation of persons				
Common carrier	0	3,652	3,865	213
Mileage	3	27	27	0
Per diem/actual	0	4,815	5,095	280
Other	0	1,538	1,631	93
Subtotal	3	10,032	10,618	586
22 Transportation of things	25	1,586	1,731	145
23.1 Rental payments to GSA	(4)	0	0	0
23.2 Rental payments to others	0	1,248	1,248	0

Object Class	2008 Adjustments to Base	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
23.3 Communications, utilities, and miscellaneous charges				
Rental of ADP equipment	1	39	49	10
Rental of office copying equipment	4	222	223	1
Other equipment rental	13	648	719	71
Federal telecommunications system	29	255	285	30
Other telecommunications services	0	1,277	1,402	125
Postal Service by USPS	15	131	131	0
Utilities:				
Electric	664	15,958	16,473	515
Gas	220	10,913	11,312	399
Water/Sewer	25	1,556	1,626	70
Subtotal	971	30,999	32,220	1,221
24 Printing and reproduction				
Publications	4	148	166	18
Other	8	364	417	53
Subtotal	12	512	583	71
25.1 Advisory and assistance services				
Management & professional support services	5	100	100	0
Studies, analyses, & evaluation	1	0	0	0
Engineering & technical services	3	354	354	0
Subtotal	9	454	454	0
25.2 Other services				
Training	23	2,443	2,675	232
ADP Services	7	1,251	1,349	98
Other non-government contracts	1,348	39,616	43,197	3,581
Subtotal	1,378	43,310	47,221	3,911

Object Class	2008 Adjustments to Base	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
25.3 Purchases of goods and services from Government accounts				
Payments to DM, WCF	110	7,365	7,365	0
[Commerce Business System (shared)]	[0]	[1,279]	[1,279]	[0]
Office of Personnel Management	2	131	131	0
Other Federal agencies:				
Department of Commerce	64	6,680	8,872	2,192
Other	113	5,860	5,962	102
Subtotal	289	20,036	22,330	2,294
25.5 Research and development contracts	92	8,958	13,703	4,745
25.7 Operation and maintenance of equipment	113	12,731	13,123	392
26 Supplies and materials				
Office & laboratory supplies	143	18,615	20,393	1,778
Scientific publications & journals	108	1,300	1,300	0
Fuel oil	2	221	221	0
Reactor materials	40	5,086	5,086	0
Subtotal	293	25,222	27,000	1,778
31 Equipment				
Office machines and other equipment	16	14,686	15,526	840
ADP equipment	173	7,779	8,089	310
Equipment amortization	121	13,942	13,942	0
Subtotal	310	36,407	37,557	1,150
32 Land and structures	0	7	7	0

	Object Class	2008 Adjustments to Base	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
41	Grants, subsidies, and contributions	0	34,816	36,866	2,050
42	Insurance claims and indemnities	0	0	0	0
43	Interest and dividends	0	7	7	0
99	Total Obligations	12,265	469,267	492,267	23,000
	Less Prior Year Recoveries	(1,000)	(1,000)	(1,000)	0
	Total Budget Authority	11,265	468,267	491,267	23,000
	Transfer to NIST Working Capital Fund	0	10,000	12,500	2,500
	Transfer from Election Assistance Commission	0	0	(3,250)	(3,250)
	Total Requirements	11,265	478,267	500,517	22,250

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
SUMMARY OF INFORMATION TECHNOLOGY RESOURCES
(Dollar amounts in thousands)
(Budget Authority)

IT Projects by Activity/Subactivity: (Totals by Activity)	Unique Project Identifier	IT Investment Title	2006 Actual	2007 Estimate	2008 Estimate	Increase/ Decrease
NIST Laboratories						
	006-55-01-01-02-7025-00	Commerce Business Systems	$6,680	$8,211	$8,277	$66
	006-55-01-01-02-7011-00	Other Financial Systems	4,663	4,782	4,917	135
	006-55-01-26-01-7045-00	NIST Central IT Support for Sciene	4,379	4,471	4,552	81
	006-55-01-26-02-7021-00	NIST Laboratories	15,069	15,453	15,883	430
	006-55-02-00-02-7022-00	NIST IT Intrastructure and Office Automation	1,936	1,981	2,029	48
Baldrige National Quality Program (BNQP)						
	006-55-01-22-02-7030-00	BNQP systems	409	420	431	11
Total			33,136	35,318	36,089	771

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
APPROPRIATION LANGUAGE AND CODE CITATIONS

1. For necessary expenses of the National Institute of Standards and Technology,

15 U.S.C. 272; 273; 278b-j; p
15 U.S.C. 290b-f
15 U.S.C. 1151-52
15 U.S.C. 1454(d-e)
15 U.S.C. 1511, 1512
15 U.S.C. 3710a-d
15 U.S.C. 3711a
15 U.S.C. 7301-7313
15 U.S.C. 7406
15 U.S.C. 7506(a)

15 U.S.C. 272; 273; 278b-j; p provides basic authority for the performance of the functions and activities of the National Institute of Standards and Technology, authorizes appropriations for these purposes to be provided to the general public and specific institutions, governments, firms, and individuals, and requires the notification of Congress of a reprogramming of funds that exceeds a limit specified in public law.

15 U.S.C. 290b-f directs the Secretary of Commerce to provide for the collection, compilation, critical evaluation, publication, and dissemination of standard reference data and the authority to establish a non-agricultural technology office.

15 U.S.C. 1151-1152 establishes within the Department of Commerce, a central clearinghouse for technical information useful to American business and industry and provides for the dissemination of this technical, scientific information via the National Technical Information Service.

15 U.S.C. 1454(d-e) provides NIST with the authority to request that manufacturers and distributors of a commodity participate in voluntary product standards when there is undue proliferation of weights, measures, and quantities. Reports and recommendations to Congress are to be made upon industry failure to adopt these standards.

15 U.S.C. 1511, 1512 specifies that all bureaus of the Department of Commerce come under the authority of the Secretary of Commerce and that such bureaus including NIST shall be subject to the authority of the Secretary of Commerce.

15 U.S.C. 3710a-d provides the authority to enter into CRADAs, to make cash awards to scientific personnel for inventions, to retain royalties and to distribute royalties for inventions, and to communicate and coordinate for the Offices of Research and Technology Applications in Federal laboratories.

15 U.S.C. 3711a provides the authority for the Baldrige National Quality award.

15 U.S.C. 7301-7313 establishes National Construction Safety Teams within NIST to respond to building and structural emergencies.

15 U.S.C. 7406 provides authority for NIST to conduct Cyber Security Research and Development to minimize security risks associated with computer systems used by the Federal government.

15 U.S.C. 7506(a) provides for the establishment of a nanotechnology research and development program within NIST.

2. $500,517,000, to remain available until expended,

no specific authority

3. of which not to exceed $12,500,000 may be transferred to the "Working Capital Fund."

15 U.S.C. 278b

15 U.S.C. 278b provides in part: "The National Institute of Standards and Technology is authorized to utilize in the performance of its functions the Working Capital Fund".

Additional authorizing legislation will be proposed for FY 2008.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
ADVISORY AND ASSISTANCE SERVICES
(Obligations in thousands of dollars)

	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate
Management and professional support services	$734	$97	$100
Studies, analyses, and evaluations	789	915	0
Engineering and technical services	655	852	354
Total	2,178	1,864	454

Significant Activities

Advisory and assistance services funded by the STRS appropriation include the review and evaluation of the technical functions and operations of NIST by the Board on Assessment of the National Academy of Sciences. The Evaluation Panels consider the importance and relative priority of projects, quality of staff, equipment needs, and finances, and the relation of the programs to the mission of NIST.

Need for Advisory and Assistance Services:

The need for advisory and assistance services stems from the NIST role in dealing with the private sector, professional organizations, and the public sector. Inputs must be obtained from consultants who can bring their individual expertise to bear and help NIST in assessing its program plans to meet the needs of its customers. The alternative to utilizing these services is to make no attempt to have expertise from sources outside NIST and risk degradation of the working and professional relationship with those in the business of using the products and services offered by NIST.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
SUMMARY OF RESOURCE REQUIREMENTS
(Dollar amounts in thousands)

	Positions	FTE	Budget Authority	Direct Obligations	Appro-priation
2007 Continuing Resolution	96	125	$92,000	$119,760	$92,000
Adjustment to support level in 2007 President's Budget	(29)	(22)	(45,668)	(45,668)	(45,668)
less: Unobligated balance from prior year	0	0	0	(30,080)	0
plus: 2007 unobligated balance	0	0	0	6,120	0
2008 Adjustments to base:					
plus: Restoration of 2007 deobligation offset	0	0	2,500	(1,300)	2,500
plus: Uncontrollable cost changes	0	0	1,253	1,253	1,253
less: Amount absorbed	(19)	(31)	(1,253)	(1,253)	(1,253)
plus: 2007 unobligated balance	0	0	0	6,120	0
less: Estimated recoveries 2008	0	0	(2,500)	0	(2,500)
less: Unobligated balance end of year	0	0	0	(2,465)	0
2008 Base Request	48	72	46,332	52,487	46,332
less: 2008 Program changes	0	0	0	0	0
2008 Estimate	48	72	46,332	52,487	46,332

		2006 Actual		2007 Continuing Resolution *		2008 Base		2008 Estimate		Increase/ (Decrease) Over 2008 Base	
Comparison by activity/subactivity:		Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount
Advanced technology program and Hollings manufacturing extension partnership	Pos./Approp	0	0	0	$92,000	0	0	0	0	0	0
Advanced technology program											
Advanced technology program	Pos./Approp	122	$78,978	38	0 *	19	0	19	0	0	0
	FTE/Obl.	134	72,583	61	25,783	30	$6,155	30	$6,155	0	0
Hollings manufacturing extension partnership											
Hollings manufacturing extension partnership	Pos./Approp	62	104,646	58	0 *	29	46,332	29	46,332	0	0
	FTE/Obl.	67	111,296	64	93,977	42	46,332	42	46,332	0	0
TOTALS	Pos./Approp	184	183,624	96	92,000	48	46,332	48	46,332	0	0
	FTE/Obl.	201	183,879	125	119,760	72	52,487	72	52,487	0	0

* *The 2007 House appropriations bill provides MEP $92M; however, ATP is funded in the same account, and OMB has allocated this funding to MEP ($52M) and ATP ($40M) to avoid any potential for terminating ATP under the CR.*

Comparison by activity/subactivity:	2006 Actual		2007 Continuing Resolution *		2008 Base		2008 Estimate		Increase/ (Decrease) Over 2008 Base	
	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount
Adjustments for:										
Recoveries		(7,376)		(3,800)		(2,500)		(2,500)		0
Refunds		(361)		0		0		0		0
Unobligated balance, start of year		(29,598)		(30,080)		(6,120)		(6,120)		0
Unobligated balance, end of year		30,080		6,120		2,465		2,465		0
Budget Authority		176,624		92,000		46,332		46,332		0
Unobligated balance rescission		7,000		0		0		0		0
Financing from transfers:										
Transfers to other accounts (+)		0		0		0		0		0
Appropriation		183,624		92,000		46,332		46,332		0

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
ADJUSTMENTS TO BASE
(Dollar amounts in thousands)

	Perm. Pos.	FTE	Amount
Adjustments:			
Next phase of ATP reduction	(19)	(11)	0
Restoration of FY 2007 deobligation offset	...	...	$2,500
Financing:			
Recoveries of prior year deobligations	...	...	(2,500)
Other Changes:			
Annualization of 2007 Pay raise	...	...	42
2008 Pay increase and related costs	...	...	141
Annualization of position reductions in FY 2007	...	(20)	0
Change in compensable days	...	...	42
Personnel Benefits:			
Civil Service Retirement System (CSRS)	...	...	(5)
Federal Employees' Retirement System (FERS)	...	...	8
Thrift Savings Plan (TSP)	...	...	101
Federal Insurance Contribution Act (FICA) - OASDI	...	...	7
Health insurance	...	...	19
Employees' Compensation Fund	...	...	(2)
Communications, utilities, and miscellaneous charges:			
Electricity rate increase	...	...	22
Natural gas rate increase	...	...	99
HMEP Center salaries	...	...	692
Other services:			
Working Capital Fund (Departmental Management)	...	...	8
General pricing level adjustment:			
Rental payments to others	...	...	1
Communications, utilities, and miscellaneous charges	...	...	2
Other services	...	...	73
Equipment	...	...	3
Subtotal, Other changes	0	(20)	1,253
Total, Adjustments to base required	(19)	(31)	1,253
Amount absorbed	0	0	(1,253)
Total, Adjustments to base requested	(19)	(31)	0

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
JUSTIFICATION OF ADJUSTMENTS TO BASE
(Dollar amounts in thousands)

	FTE	Amount
Adjustments:		
Next phase of ATP reduction	(11)	0

Consistent with the FY 2007 President's Budget, the next phase of the ATP reduction will result in the loss of 19 permanent positions and 11 FTE.

Restoration of FY 2007 deobligation offset		$2,500

In FY 2007, NIST's ITS budget authority was reduced by $3,800,000 based on an estimated level of ATP prior year deobligations. This adjustment would restore $2,500,000 in FY 2008.

Subtotal, Adjustments	(11)	2,500
Financing:		
Recoveries of prior year obligations	0	(2,500)

This reduction is the estimated level of ATP prior year deobligations in FY 2008.

Other Changes:

Annualization of 2007 pay raise 0 42

A pay raise of 2.2 percent is assumed to be effective January 1, 2007.

Total cost in FY 2008 of 2007 pay raise	$166,667
Less amount requested in FY 2007	(125,000)
Less amount absorbed in FY 2007	0
Amount requested in 2008 to provide full-year cost of 2007 pay raise	41,667
Payment to Departmental Management Working Capital Fund	0
Total, FY 2007 pay raise increase in FY 2008	41,667

2008 Pay increase and related costs 0 141

A general pay raise of 3.0 .percent is assumed to be effective January 1, 2008.

Total cost in FY 2008 of pay increase.	$125,000
Amount absorbed in FY 2008	0
Amount requested for FY 2008 pay raise	125,000
Payment to Departmental Management Working Capital Fund	16,000
Total adjustment for FY 2008 pay increase	141,000

Annualization of position reductions in FY 2007 ..... (20) 0

This adjustment annualizes the position reductions proposed in the FY 2007 President's budget.

Change in compensable days 0 42

The increased cost of two more compensable days in FY 2008 compared to FY 2007 is calculated by dividing the FY 2007 estimated personnel compensation ($4,613,000) and applicable benefits ($861,000) by 260 compensable days. The cost increase of two more compensable days is $42,108.

Personnel benefits.	0	128

Civil Service Retirement System (CSRS)	($5)
Federal Employees' Retirement System (FERS)	8
Thrift Savings Plan (TSP)	101
Federal Insurance Contribution Act (FICA) – OASDI	7
Health Insurance	19
Employees' Compensation Fund	(2)

Civil Service Retirement System (-$5,000) – The number of employees covered by the Civil Service Retirement System (CSRS) continues to drop as positions become vacant and are filled by employees who are covered by the Federal Employees' Retirement System (FERS). The estimated percentage of payroll for employees covered by CSRS will decrease from 20.2 percent in FY 2007 to 18.6 percent in FY 2008. The contribution rate will remain at 7.0 percent in FY 2008.

Payroll subject to retirement systems ($4,603,774)	
Cost of CSRS contributions in FY 2008 ($4,603,774 x .186 x .07)	$59,941
Cost of CSRS contributions in FY 2007 ($4,603,774 x .202 x .07)	65,097
Total adjustment to base	(5,156)

Federal Employees' Retirement System ($8,000) – The number of employees covered by FERS continues to rise as employees covered by CSRS leave and are replaced by employees covered by FERS. The estimated percentage of payroll for employees covered by FERS will increase from 79.8 percent in FY 2007 to 81.4 percent in FY 2008. The contribution rate will remain at 11.2 percent in FY 2008.

Payroll subject to retirement systems ($4,603,774)	
Basic benefit cost in FY 2008 ($4,603,774 x .814 x .112)	$419,717
Basic benefit cost in FY 2007 ($4,603,774 x .798 x .112)	411,467
Total adjustment to base	8,250

Thrift Savings Plan ($101,000) – The cost of agency contributions to the Thrift Savings Plan will also rise as FERS participation increases. The contribution rate has increased from 2.00 percent to 4.65 percent.

Thrift plan cost in FY 2008 ($4,603,774 x .814 x .0465)	$174,257
Thrift plan cost in FY 2007 ($4,603,774 x .798 x .0200)	73,476
Total adjustment to base	100,781

Federal Insurance Contributions Act (FICA) - OASDI ($7,000) – As the percentage of payroll covered by FERS increases, the cost of OASDI contributions will increase. In addition, the maximum salary subject to OASDI tax will increase from $96,150 in FY 2007 to $102,300 in FY 2008. The OASDI tax rate will remain 6.2 percent in FY 2008.

FERS payroll subject to FICA tax in 2008 ($4,603,774 x .814 x .902 x .062)	$209,574
FERS payroll subject to FICA tax in 2007 ($4,603,774 x .798 x .892 x .062)	203,176
Increase (FY 2007-FY 2008)	6,398
OTP payroll subject to FICA tax in 2008 ($157,226 x .814 x .902 x .062)	7,157
OTP payroll subject to FICA tax in 2007 ($157,226 x .798 x .892 x .062)	6,939
Increase (FY 2006-2007)	218
Total adjustment to base	6,616

Health insurance ($19,000) – Effective January 2006, NIST's contribution to Federal employees' health insurance premiums increased by 6.7 percent. Applied against the FY 2007 estimate of $287,000, the additional amount required is $19,229.

Employees Compensation Fund (-$2,000) – The Employees' Compensation Fund bill for the year ending June 30, 2006, is a net $63,000 lower than for the year ending June 30, 2005. The ITS share of the decrease is $2,000.

Communications, utilities, and miscellaneous charges		0	121
Electricity rate increase	22		
Natural gas rate increase	99		

Electricity rate increase ($22,000) – PEPCO/Reliant (Gaithersburg site) and Kauai Energy Services (Hawaii site) have had rate increases of 21.0 and 11.3 percent, respectively, per kilowatt hour for electricity service to NIST facilities. Applied to the FY 2007 estimates by site, the adjustment to base is $22,000.

Natural gas rate increase ($99,000) – Washington Gas (Gaithersburg site) and Seminole Energy Services (Boulder site) have had rate increases of 80.1 and 74.0 percent, respectively, per therm for natural gas service to NIST facilities. Applied to the FY 2007 estimates by site, the adjustment to base is $99,000.

Hollings Manufacturing Extension Center salaries	0	692

This adjustment is to increase the Federal amount of reimbursements to the Hollings Manufacturing Extension Centers to cover the cost of living wage and benefit increases paid to non-Federal employees of the centers.

Other services	0	8

An additional $8,000 is required to fund cost increases in the Departmental Management Working Capital Fund.

General pricing level adjustment	0	79

This request applies the OMB economic assumptions of 1.8 percent for FY 2008 where the prices that the government pays are established through the market system. Factors are applied to sub-object classes that result in the following adjustments to base: rental payments to others $1,386; communications, utilities, and miscellaneous charges $1,620; other services $73,458; and equipment $2,520.

Subtotal, Other changes	(20)	1,253
Total, adjustments to base required	(31)	1,253

Less amount absorbed[1]	0	(1,253)
Total, adjustments to base requested	(31)	0

[1] *NIST will absorb $1,253,000 of adjustments to base in ITS through reductions in all applicable object classes.*

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Advanced technology program
Subactivity: Advanced technology program

Line Item		2006 Actual Personnel	2006 Actual Amount	2007 Continuing Resolution * Personnel	2007 Continuing Resolution * Amount	2008 Base Personnel	2008 Base Amount	2008 Estimate Personnel	2008 Estimate Amount	Increase/ (Decrease) Over 2008 Base Personnel	Increase/ (Decrease) Over 2008 Base Amount
Advanced technology program	Pos./Approp	122	$78,978	38	0 *	19	0	19	0	0	0
	FTE/Obl.	134	72,583	61	$25,783	30	$6,155	30	$6,155	0	0

* The 2007 House appropriations bill provides MEP $92M; however, ATP is funded in the same account, and OMB has allocated this funding to MEP ($52M) and ATP ($40M) to avoid any potential for terminating ATP under the CR.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Advanced technology program
Subactivity: Advanced technology program

Line Item	2006 Actual		2007 Continuing Resolution		2008 Base		2008 Estimate		Increase/ (Decrease) Over 2008 Base	
	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
Advanced technology program										
WCF transfer		0		0		0		0		0
Reimbursables	1	$95	0	$3	0	0	0	0	0	0
WCF investments	0	22	0	4	0	0	0	0	0	0
Total	1	117	0	7	0	0	0	0	0	0

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
ADVANCED TECHNOLOGY PROGRAM

The Advanced Technology Program provided grants to business for the development of high-risk technologies. Appropriations remaining from prior fiscal years are sufficient to phase out the program. No FY 2008 funds are requested.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Advanced Technology Program
REIMBURSABLE PROGRAM AND WORKING CAPITAL FUND INVESTMENTS
(Dollar amounts in thousands)

	FY 2006 Actual	FY 2007 Continuing Resolution	FY 2008 Estimate
Department of Commerce	$93	0	0
Subtotal, Federal Agencies	93	0	0
Technical & Advisory Services	2	$3	0
Subtotal, Other Reimbursables	2	3	0
Total, Reimbursable Program	95	3	0
Equipment Investments	133	27	0
IE Amortization	(111)	(23)	0
Total, WCF Investments	22	4	0
Total, Reimbursable Program and WCF Investments	117	7	0

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Hollings manufacturing extension partnership
Subactivity: Hollings manufacturing extension partnership

Line Item		2006 Actual Personnel	2006 Actual Amount	2007 Continuing Resolution * Personnel	2007 Continuing Resolution * Amount	2008 Base Personnel	2008 Base Amount	2008 Estimate Personnel	2008 Estimate Amount	Increase/ (Decrease) Over 2008 Base Personnel	Increase/ (Decrease) Over 2008 Base Amount
Hollings manufacturing	Pos./Approp	62	$104,646	58	0 *	29	$46,332	29	$46,332	0	0
extension partnership	FTE/Obl.	67	111,296	64	$93,977	42	46,332	42	46,332	0	0

* The 2007 House appropriations bill provides MEP $92M; however, ATP is funded in the same account, and OMB has allocated this funding to MEP ($52M) and ATP ($40M) to avoid any potential for terminating ATP under the CR.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Hollings manufacturing extension partnership
Subactivity: Hollings manufacturing extension partnership

	2006 Actual		2007 Continuing Resolution		2008 Base		2008 Estimate		Increase/ (Decrease) Over 2008 Base	
Line Item	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
Hollings manufacturing extension partnership										
WCF transfer		0		0		0		0		0
Reimbursables	0	$612	0	$1,420	0	$94	0	$94	0	0
WCF investments	0	15	0	9	0	0	0	0	0	0
Total	0	627	0	1,429	0	94	0	94	0	0

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
HOLLINGS MANUFACTURING EXTENSION PARTNERSHIP

Goal Statement

This program supports NIST's mission of promoting U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life. This program also supports the Department of Commerce (DoC) strategic goal to provide the information and tools to maximize U.S. competitiveness and enable economic growth for American industries, workers, and consumers. To achieve the NIST goal and realize the DoC strategic goal, the Hollings Manufacturing Extension Partnership (MEP) Program provides small U.S. manufacturers with information, decision support, and implementation assistance in adopting advanced manufacturing technologies, tools, and business best practices.

Base Program

The MEP program is a Federal-state-local partnership that provides small U.S. manufacturers with access to technologies, resources, and expertise. The MEP program consists of manufacturing extension centers, which are linked to state, university, and private sources of technology and expertise. Funding for the MEP centers is a cost-sharing arrangement consisting of support from the Federal government, state and local government, and the charging of fees for services. MEP, rated moderately effective under a PART assessment in 2002, is considered well-managed and new centers are established through a competitive process.

The MEP centers are working to position small manufacturers to compete in the global economy through services that are grounded in business strategy development, advanced marketing techniques, new product development, the integration of supply chains, and increasing the technical and problem solving skills of the workforce.

Guided by MEP's Next Generation strategy and building upon efforts to further advance the goal of increasing the competitiveness of small manufacturers, the program is committed to fostering high performance centers responsive to the most pressing challenges and needs confronting large numbers of small manufacturers. MEP is based on the principles of the NIST Baldrige National Quality

Program evaluation criteria as a framework for generating continuous improvement in center performance and impact. As a system, MEP is improving manufacturing competitiveness throughout the United States.

The FY 2008 base program operating objectives for the MEP program include the following:

- Complete the competition started in FY 2007 to reconstitute a subset of the highest-performing MEP centers with final decisions and competition awards to be made in FY 2008.
- Build selected partnerships with state and local governments and Federal agencies focused on developing support for MEP services.
- Manage and evaluate the new MEP centers.

Performance Measures

Data on NIST programmatic performance evaluation and reporting are provided in Exhibit 3A of this budget request.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Hollings Manufacturing Extension Partnership
REIMBURSABLE PROGRAM AND WORKING CAPITAL FUND INVESTMENTS
(Dollar amounts in thousands)

	FY 2006 Actual	FY 2007 Continuing Resolution	FY 2008 Estimate
Department of Defense			
Navy	$300	0	0
Subtotal, Department of Defense	300	0	0
Department of Health & Human Services	0	$800	0
Department of Homeland Security	0	573	$94
Environmental Protection Agency	312	47	0
Subtotal, Federal Agencies	612	1,420	94
Total, Reimbursable Program	612	1,420	94
Equipment Investments	87	66	79
IE Amortization	(72)	(57)	(79)
Total, WCF Investments	15	9	0
Total, Reimbursable Program and WCF Investments	627	1,429	94

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
SUMMARY OF REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

	Object Class	2006 Actual	2007 Continuing Resolution	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
11	Personnel compensation					
11.1	Full-time permanent	$17,652	$11,804	$7,259	$7,259	0
11.3	Other than full-time permanent	1,286	584	384	384	0
11.5	Other personnel compensation	517	292	212	212	0
11.9	Total personnel compensation	19,455	12,680	7,855	7,855	0
12.1	Civilian personnel benefits	4,898	3,102	1,851	1,851	0
13	Benefits for former personnel	77	1	1	1	0
21	Travel and transportation of persons	845	571	442	442	0
22	Transportation of things	31	22	14	14	0
23.1	Rental payments to GSA	2	0	0	0	0
23.2	Rental payments to others	512	77	36	36	0
23.3	Communications, utilities, and miscellaneous charges	3,361	1,963	964	964	0
24	Printing and reproduction	26	17	8	8	0
25.1	Advisory and assistance services	2,213	1,184	723	723	0
25.2	Other services	6,311	15,728	4,264	4,264	0
25.3	Purchases of goods and services from government accounts	1,451	828	498	498	0
25.5	Research and development contracts	1,207	124	0	0	0
25.7	Operation and maintenance of equipment	1,184	347	124	124	0
26	Supplies and materials	1,103	772	419	419	0
31	Equipment	945	505	288	288	0
32	Land and structures	0	0	0	0	0
41	Grants, subsidies, and contributions	140,256	81,839	35,000	35,000	0
42	Insurance claims and indemnities	2	0	0	0	0
99	Total Obligations	183,879	119,760	52,487	52,487	0

	Object Class	2006 Actual	2007 Continuing Resolution	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
99	Total Obligations	183,879	119,760	52,487	52,487	0
	Less Prior Year Recoveries	(7,376)	(3,800)	(2,500)	(2,500)	0
	Less Prior Year Refunds	(361)	0	0	0	0
	Less Prior Year Unobligated Balance	(29,598)	(30,080)	(6,120)	(6,120)	0
	Plus Unobligated Balance End of Year	30,080	6,120	2,465	2,465	0
	Total Budget Authority	176,624	92,000	46,332	46,332	0
	Plus Unobligated Balance Rescission	7,000	0	0	0	0
	Appropriation	183,624	92,000	46,332	46,332	0
	Personnel Data					
	Full-time equivalent employment:					
	Full-time permanent	193	119	68	68	0
	Other than full-time permanent	8	6	4	4	0
	Total	201	125	72	72	0
	Authorized Positions:					
	Full-time permanent	176	90	45	45	0
	Other than full-time permanent	8	6	3	3	0
	Total	184	96	48	48	0

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
DETAILED REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

	Object Class	2008 Adjustments to Base	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
11	Personnel compensation				
11.1	Full-time permanent				
	Executive level	0	0	0	0
	Senior executive service	0	$473	$473	0
	Career path	0	6,786	6,786	0
	Wage board	0	0	0	0
	Scientific & professional (P.L. 80-313)	0	0	0	0
	Subtotal	0	7,259	7,259	0
11.3	Other than full-time permanent				
	Career path	0	384	384	0
	Wage board	0	0	0	0
	Scientific & professional (P.L. 80-313)	0	0	0	0
	Experts & consultants	0	0	0	0
	Subtotal	0	384	384	0
11.5	Other personnel compensation				
	Overtime	0	38	38	0
	SES performance awards	0	30	30	0
	Cash awards	0	144	144	0
	Other	0	0	0	0
	Subtotal	0	212	212	0
11.9	Total personnel compensation	0	7,855	7,855	0

	Object Class	2008 Adjustments to Base	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
12.1	Civilian personnel benefits				
	Civil service retirement	0	136	136	0
	Federal employees' retirement	0	583	583	0
	Thrift savings plan	0	264	264	0
	Federal Insurance Contribution Act	0	370	370	0
	Health insurance	0	464	464	0
	Life insurance	0	10	10	0
	Employees' Compensation Fund	0	13	13	0
	Other	0	11	11	0
	Subtotal	0	1,851	1,851	0
13	Benefits for former personnel				
	Severance pay	0	0	0	0
	Unemployment compensation	0	1	1	0
	Other	0	0	0	0
	Subtotal	0	1	1	0
21	Travel and transportation of persons				
	Common carrier	0	181	181	0
	Mileage	0	0	0	0
	Per diem/actual	0	175	175	0
	Other	0	86	86	0
	Subtotal	0	442	442	0
22	Transportation of things	0	14	14	0
23.1	Rental payments to GSA	0	0	0	0
23.2	Rental payments to others	0	36	36	0

	Object Class	2008 Adjustments to Base	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
23.3	Communications, utilities, and miscellaneous charges				
	Rental of ADP equipment	0	0	0	0
	Rental of office copying equipment	0	6	6	0
	Other equipment rental	0	21	21	0
	Federal telecommunications system	0	6	6	0
	Other telecommunications services	0	53	53	0
	Postal Service by USPS	0	6	6	0
	Utilities:				
	Electric	0	415	415	0
	Gas	0	415	415	0
	Water/Sewer	0	42	42	0
	Subtotal	0	964	964	0
24	Printing and reproduction				
	Publications	0	4	4	0
	Other	0	4	4	0
	Subtotal	0	8	8	0
25.1	Advisory and assistance services				
	Management & professional support services	0	435	435	0
	Studies, analyses, & evaluation	0	288	288	0
	Engineering & technical services	0	0	0	0
	Subtotal	0	723	723	0
25.2	Other services				
	Training	0	49	49	0
	ADP Services	0	456	456	0
	Other non-government contracts	0	3,759	3,759	0
	Subtotal	0	4,264	4,264	0
25.3	Purchases of goods and services from Government accounts				
	Payments to DM, WCF	0	373	373	0
	Office of Personnel Management	0	10	10	0
	Other Federal agencies:				
	Department of Commerce	0	37	37	0
	Other	0	78	78	0
	Subtotal	0	498	498	0

	Object Class	2008 Adjustments to Base	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
25.5	Research and development contracts	0	0	0	0
25.7	Operation and maintenance of equipment	0	124	124	0
26	Supplies and materials				
	Office & laboratory supplies	0	335	335	0
	Scientific publications & journals	0	70	70	0
	Fuel oil	0	14	14	0
	Subtotal	0	419	419	0
31	Equipment				
	Office machines and other equipment	0	84	84	0
	ADP equipment	0	126	126	0
	Equipment amortization	0	78	78	0
	Subtotal	0	288	288	0
32	Land and structures	0	0	0	0
41	Grants, subsidies, and contributions	0	35,000	35,000	0
42	Insurance claims and indemnities	0	0	0	0
99	Total Obligations	0	52,487	52,487	0
	Less Prior Year Recoveries	0	(2,500)	(2,500)	0
	Less Unobligated Balance start of year	0	(6,120)	(6,120)	0
	Plus Unobligated Balance end of year	0	2,465	2,465	0
	Total Budget Authority	0	46,332	46,332	0
	Transfer to NIST Working Capital Fund	0	0	0	0
	Total Requirements	0	46,332	46,332	0

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
SUMMARY OF INFORMATION TECHNOLOGY RESOURCES
(Dollar amounts in thousands)
(Budget Authority)

IT Projects by Activity/Subactivity: (Totals by Activity)	Unique Project Identifier	IT Investment Title	2006 Actual	2007 Estimate	2008 Estimate	Increase/ Decrease
Advanced Technology Program	006-55-01-27-02-7040-00	ATP Systems	$1,515	0	0	0
Hollings Manufacturing Extension Partnership Program	006-55-01-18-02-7050-00	MEP Systems	1,019	$887	$907	$20
Total			2,534	887	907	20

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
APPROPRIATION LANGUAGE AND CODE CITATIONS

1. For necessary expenses of the Hollings Manufacturing Extension Partnership Program of the National Institute of Standards and Technology,

15 U.S.C.271
15 U.S.C. 278b
15 U.S.C. 278k
15 U.S.C. 278l
15 U.S.C. 278n
15 U.S.C. 7506(b)(2)

15 U.S.C. 271 provides for NIST to support State technology programs supporting scientific and engineering research for accurate measurements and standards and improved technological processes.

15 U.S.C. 278b provides for a Working Capital Fund to support NIST activities.

15 U.S.C. 278k directs the Secretary, through the Director of NIST, to provide assistance for the creation of Regional Centers for the Transfer of Manufacturing Technology.

15 U.S.C. 278l provides authority for technical assistance to State technology programs.

15 U.S.C. 278n establishes the Advanced Technology Program within NIST to assist U.S. businesses in applying generic technology and research results to commercialize scientific discoveries and refine manufacturing technologies.

15 U.S.C. 7506(b)(2) instructs the NIST Director to utilize the Manufacturing Extension Partnership program to ensure that results of research on issues related to the development and manufacture of nanotechnology reach small- and medium-sized manufacturing companies.

2. $46,332,000, to remain available until expended.

no specific authority

Additional authorizing legislation will be proposed for FY 2008.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
ADVISORY AND ASSISTANCE SERVICES
(Obligations in thousands of dollars)

	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate
Management and professional support services	$895	$700	$435
Studies, analyses, and evaluations	1,318	484	288
Engineering and technical services	0	0	0
Total	2,213	1,184	723

Significant Activities

Advisory and assistance services funded by the Industrial Technology Services appropriation are used to conduct evaluations of the programmatic outcomes, service delivery efficiency, and internal infrastructure requirements of ATP and the Hollings MEP Program. ATP is not budgeted to receive new appropriations in FY 2008.

Need for Advisory and Assistance Services:

The need for advisory and assistance services stems from the role of NIST's extramural programs with its outside partners and small businesses to relate to the private sector, professional organizations, and the public sector. Inputs must be obtained from consultants who can bring their individual expertise to bear and help NIST in assessing its program plans to meet the needs of its customers. The alternative to utilizing these services is to make no attempt to have expertise from sources outside NIST and risk having a poorer working and professional relationship with those in the business of using the products and services offered by NIST. These services provide for economic assessment and external evaluation of NIST's extramural programs.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Construction of Research Facilities
SUMMARY OF RESOURCE REQUIREMENTS
(Dollar amounts in thousands)

	Positions	FTE	Budget Authority	Direct Obligations	Appro-priation
2007 Continuing Resolution	51	50	$67,998	$77,013	$67,998
Adjustment to support level in FY 2007 President's Budget	0	0	0	0	0
less: Unobligated balance from prior year	0	0	0	(9,015)	0
2008 Adjustments to base:					
less: Non-recurring 2007 costs	0	0	(22,100)	(22,100)	(22,100)
plus: Uncontrollable cost changes	0	0	991	991	991
less: Amount absorbed	0	0	(24)	(24)	(24)
2008 Base Request	51	50	46,865	46,865	46,865
plus: 2008 Program changes	0	0	47,000	47,000	47,000
2008 Estimate	51	50	93,865	93,865	93,865

		2006 Actual		2007 Continuing Resolution		2008 Base		2008 Estimate		Increase/ (Decrease) Over 2008 Base	
Comparison by activity/subactivity:		Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount
Construction and major renovations											
Construction and major	Pos/Approp	61	$173,651	51	$67,998	51	$46,865	51	$93,865	0	$47,000
renovations	FTE/Obl.	43	168,635	50	77,013	50	46,865	50	93,865	0	47,000
Adjustments for:											
Prior year recoveries			(581)		0		0		0		0
Unobligated balance, start of year			(3,418)		(9,015)		0		0		0
Unobligated balance, end of year			9,015		0		0		0		0
Financing from transfers:											
Transfers to other accounts (+)			0		0		0		0		0
Appropriation			173,651		67,998		46,865		93,865		47,000

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Construction of Research Facilities
ADJUSTMENTS TO BASE
(Dollar amounts in thousands)

	Perm. Pos.	FTE	Amount
Adjustments:			
Adjustment for Boulder/Gaithersburg construction	...	...	($22,100)
Other Changes:			
Annualization of 2007 Pay raise	...	...	23
2008 Pay increase and related costs	...	...	98
Change in compensable days	...	...	34
Personnel benefits:			
Civil Service Retirement System (CSRS)	...	...	(4)
Federal Employees' Retirement System (FERS)	...	...	6
Thrift Savings Plan (TSP)	...	...	79
Federal Insurance Contribution Act (FICA) - OASDI	...	...	5
Health insurance	...	...	18
Employees' Compensation Fund	...	...	(3)
General pricing level adjustment:			
Transportation of things	...	...	1
Communications, utilities, and miscellaneous charges	...	...	1
Other services	...	...	699
Supplies and materials	...	...	32
Equipment	...	...	2
Subtotal, Other changes	0	0	991
Total, Adjustments to base required			(21,109)
Amount absorbed			(24)
Total, Adjustments to base requested	0	0	(21,133)

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Construction of Research Facilities
JUSTIFICATION OF ADJUSTMENTS TO BASE
(Dollar amounts in thousands)

	FTE	Amount
Adjustments:		
Adjustment for Boulder/Gaithersburg construction	0	($22,100)

The FY 2007 President's Budget included one-time increases totaling $22,100,000 for the construction and modernization of facilities at the Gaithersburg, Maryland, and Boulder, Colorado worksites.

Other Changes:		
Annualization of 2007 pay raise	0	23

A pay raise of 2.2 percent is assumed to be effective January 1, 2007.

Total cost in FY 2008 of 2007 pay raise	$90,667
Less amount requested in FY 2007	(68,000)
Less amount absorbed in FY 2007	0
Amount requested in 2008 to provide full-year cost of 2007 pay raise	22,667
Payment to Departmental Management Working Capital Fund	0
Total FY 2007 pay raise increase in FY 2008	22,667

2008 Pay increase and related costs 0 98

A general pay raise of 3.0 percent is assumed to be effective January 1, 2008.

Total cost in FY 2008 of pay increase	$98,000
Less amount absorbed in FY 2008	0
Amount requested for FY 2008 pay increase	98,000
Payment to Departmental Management Working Capital Fund	0
Total adjustment for FY 2008 pay increase	98,000

Change in compensable days 0 34

The increased cost of two more compensable days in FY 2008 compared to FY 2007 is calculated by dividing the FY 2007 estimated personnel compensation ($3,620,000) and applicable benefits ($788,000) by 260 compensable days. The cost increase of two more compensable days is $33,908.

Personnel benefits 0 101

Civil Service Retirement System (CSRS)	($4)
Federal Employees' Retirement System (FERS)	6
Thrift Savings Plan (TSP)	79
Federal Insurance Contribution Act (FICA) - OASDI	5
Health Insurance	18
Employees' Compensation Fund	(3)

Civil Service Retirement System (-$4,000) – The number of employees covered by the Civil Service Retirement System (CSRS) continues to drop as positions become vacant and are filled by employees who are covered by the Federal Employees Retirement System (FERS). The estimated percentage of payroll for employees covered by CSRS will decrease from 20.2 percent in FY 2007 to 18.6 percent in FY 2008. The contribution rate will remain at 7.0 percent in FY 2008.

Payroll subject to retirement systems ($3,612,760)	
Cost of CSRS contributions in FY 2008 ($3,612,760 x .186 x .07)	$47,038
Cost of CSRS contributions in FY 2007 ($3,612,760 x .202 x .07)	51,084
Total adjustment to base	(4,046)

Federal Employees' Retirement System ($6,000) – The number of employees covered by FERS continues to rise as employees covered by CSRS leave and are replaced by employees covered by FERS. The estimated percentage of payroll for employees covered by FERS will increase from 79.8 percent in FY 2007 to 81.4 percent in FY 2008. The contribution rate will remain at 11.2 percent in FY 2008.

Payroll subject to retirement systems ($3,612,760)	
Basic benefit cost in FY 2008 ($3,612,760 x .814 x .112)	$329,368
Basic benefit cost in FY 2007 ($3,612,760 x .798 x .112)	322,894
Total adjustment to base	6,474

Thrift Savings Plan ($79,000) – The cost of agency contributions to the Thrift Savings Plan will also rise as FERS participation increases. The contribution rate increased from 2.00 percent to 4.65 percent.

Thrift plan cost in FY 2008 ($3,612,760 x .814 x .0465)	$136,747
Thrift plan cost in FY 2007 ($3,612,760 x .798 x .0200)	57,660
Total adjustment to base	79,087

Federal Insurance Contributions Act (FICA) - OASDI ($5,000) – As the percentage of payroll covered by FERS increases, the cost of OASDI contributions will increase. In addition, the maximum salary subject to OASDI tax will increase from $96,150 in FY 2007 to $102,300 in FY 2008. The OASDI tax rate will remain 6.2 percent in FY 2007.

FERS payroll subject to FICA tax in 2008 ($3,612,760 x .814 x .902 x .062).....	$164,461
FERS payroll subject to FICA tax in 2007 ($3,612,760 x .798 x .892 x .062).....	159,440
Increase (FY 2007-FY 2008)	5,021
OTP payroll subject to FICA tax in FY 2008 ($342,240 x .814 x .902 x .062)	15,579
OTP payroll subject to FICA tax in FY 2007 ($342,240 x .798 x .892 x .062)	15,104
Increase (FY 2007-FY 2008)	475
Total adjustment to base	5,496

Health insurance ($18,000) – Effective January 2006, NIST's contribution to Federal employees' health insurance premiums increased by 6.7 percent. Applied against the FY 2007 estimate of $267,000, the additional amount required is $17,889.

Employees Compensation Fund (-$3,000) – The Employees' Compensation Fund bill for the year ending June 30, 2006, is a net $63,000 lower than for the year ending June 30, 2005. The CRF share of the decrease is $3,000.

General pricing level adjustment..... 0 735

This request applies the OMB economic assumptions of 1.8 percent for FY 2008 where the prices that the government pays are established through the market system. Factors are applied to sub-object classes that result in the following adjustments to base: transportation of things $1,458; communications, utilities, and miscellaneous charges $936; other services $699,156; supplies and materials $31,734; and equipment $1,782.

Subtotal, Other changes 0 991

Total adjustments to base..... 0 (21,109)

Less amount absorbed[1]	0	(24)
Total, adjustments to base requested	0	(21,133)

[1] *NIST will absorb $24,000 of adjustments to base in CRF through reductions in all applicable object classes.*

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Construction of Research Facilities
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Construction and major renovations
Subactivity: Construction and major renovations

Line Item		2006 Actual		2007 Continuing Resolution		2008 Base		2008 Estimate		(Increase/ Decrease) Over 2008 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount
Construction and major renovations	Pos/Approp	4	$138,607	0	$22,100	0	0	0	$47,000	0	$47,000
	FTE/Obl.	3	133,467	0	30,762	0	0	0	47,000	0	47,000
Modifications and improvements	Pos/Approp	57	35,044	51	45,898	51	$46,865	51	46,865	0	0
	FTE/Obl.	40	35,168	50	46,250	50	46,865	50	46,865	0	0
Site Security	Pos/Approp	0	0	0	0	0	0	0	0	0	0
	FTE/Obl.	0	0	0	1	0	0	0	0	0	0
Total	Pos/Approp	61	173,651	51	67,998	51	46,865	51	93,865	0	47,000
	FTE/Obl.	43	168,635	50	77,013	50	46,865	50	93,865	0	47,000

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Construction of Research Facilities
JUSTIFICATION OF PROGRAM AND PERFORMANCE
CONSTRUCTION AND MAJOR RENOVATIONS

Goal Statement

This program supports the NIST goal to promote innovation, facilitate trade, and ensure public safety and security by strengthening the Nation's measurement and standards infrastructure. This program also supports the Department of Commerce strategic goal to promote U.S. innovation and industrial competitiveness by protecting intellectual property, enhancing technical standards, and advancing measurement science.

Base Program

The base program includes funding for the construction, maintenance, repair, and improvements of facilities occupied or used by NIST in Gaithersburg, Maryland; Boulder and Fort Collins, Colorado; and Kauai, Hawaii; to meet the measurement and research needs of the 21st century. Base funding of $46.9 million is used to address the highest priority safety, capacity, maintenance and major repair projects at NIST. This will help ensure compliance with various health and safety regulations, improve access for people with disabilities, and permit the performance of maintenance and major repairs, as well as safeguard the utility infrastructure of existing buildings.

The FY 2008 base program operating objectives include the following:

- continue the repair/upgrade of facilities that have a high impact on staff and visitor safety;
- continue abatement of hazardous materials from site buildings and structures;
- continue to modify the sites to comply with the Access to Federal Buildings Act and the Americans with Disabilities Act;
- continue repairs/replacements of utility systems, exhaust and air filtration systems, mechanical-electrical systems, and site alarm and fire safety systems that are failing at an accelerated rate due to the fact that the systems are over 40 to 50 years old;
- continue architectural, structural, and energy conservation related repairs, as needed; and
- enable or maintain building environmental conditions required for meeting scientific requirements.

While a plan for the use of the base funds has been developed, it is important to note that the planned use of these funds is subject to change if and when facilities-related emergency situations arise. Also, in many cases, final cost estimates resulting from contract negotiations may affect the number of projects that can be funded.

Performance Measures

Within available resources, the goal of this program is to keep laboratory and office space safe and appropriate for the work conducted. For existing buildings, NIST will keep the average unscheduled downtime to less than seven percent of the total scheduled operating time.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Construction of Research Facilities
SUMMARY OF REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

	Object Class	2006 Actual	2007 Continuing Resolution	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
11	Personnel compensation					
11.1	Full-time permanent	$3,292	$3,947	$3,807	$3,807	0
11.3	Other than full-time permanent	0	3	5	5	0
11.5	Other personnel compensation	265	265	265	265	0
11.9	Total personnel compensation	3,557	4,215	4,077	4,077	0
12.1	Civilian personnel benefits	904	1,177	1,192	1,192	0
13	Benefits for former personnel	0	0	0	0	0
21	Travel and transportation of persons	2	2	2	2	0
22	Transportation of things	7	8	9	9	0
23.1	Rental payments to GSA	0	0	0	0	0
23.2	Rental payments to others	0	0	0	0	0
23.3	Communications, utilities, and miscellaneous charges	131	132	133	133	0
24	Printing and reproduction	0	0	0	0	0
25.1	Advisory and assistance services	2	0	0	0	0
25.2	Other services	33,869	47,997	32,717	32,717	0
25.3	Purchases of goods and services from government accounts	1	8	15	15	0
25.5	Research and development contracts	0	0	0	0	0
25.7	Operation and maintenance of equipment	2,908	2,922	2,934	2,934	0
26	Supplies and materials	1,305	1,336	1,368	1,368	0
31	Equipment	127	129	131	131	0
32	Land and structures	438	19,087	4,287	51,287	$47,000
41	Grants, subsidies, and contributions	125,378	0	0	0	0
42	Insurance claims and indemnities	6	0	0	0	0
99	Total Obligations	168,635	77,013	46,865	93,865	47,000

	Object Class	2006 Actual	2007 Continuing Resolution	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
99	Total Obligations	168,635	77,013	46,865	93,865	47,000
	Less Prior Year Recoveries	(581)	0	0	0	0
	Less Prior Year Unobligated Balance	(3,418)	(9,015)	0	0	0
	Plus Unobligated Balance End of Year	9,015	0	0	0	0
	Total Budget Authority	173,651	67,998	46,865	93,865	47,000
	Plus Transfers from Other Accounts	0	0	0	0	0
	Appropriation	173,651	67,998	46,865	93,865	47,000

Personnel Data

Full-time equivalent employment:					
Full-time permanent	43	50	50	50	0
Other than full-time permanent	0	0	0	0	0
Total	43	50	50	50	0
Authorized Positions:					
Full-time permanent	61	51	51	51	0
Other than full-time permanent	0	0	0	0	0
Total	61	51	51	51	0

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Construction of Research Facilities
DETAILED REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

	Object Class	2008 Adjustments to Base	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
11	Personnel compensation				
11.1	Full-time permanent				
	Executive level	0	0	0	0
	Senior executive service	0	0	0	0
	Career path	$86	$2,502	$2,502	0
	Wage board	48	1,305	1,305	0
	Scientific & professional (P.L. 80-313)	0	0	0	0
	Subtotal	134	3,807	3,807	0
11.3	Other than full-time permanent				
	Career path	2	5	5	0
	Wage board	0	0	0	0
	Scientific & professional (P.L. 80-313)	0	0	0	0
	Experts & consultants	0	0	0	0
	Subtotal	2	5	5	0
11.5	Other personnel compensation				
	Overtime	0	249	249	0
	SES performance awards	0	0	0	0
	Cash awards	0	16	16	0
	Other	0	0	0	0
	Subtotal	0	265	265	0
11.9	Total personnel compensation	136	4,077	4,077	0

	Object Class	2008 Adjustments to Base	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
12.1	Civilian personnel benefits				
	Civil service retirement	(3)	48	48	0
	Federal employees' retirement	15	386	386	0
	Thrift savings plan	81	208	208	0
	Federal Insurance Contribution Act	12	245	245	0
	Health insurance	18	285	285	0
	Life insurance	0	6	6	0
	Employees' Compensation Fund	(3)	10	10	0
	Other	0	4	4	0
	Subtotal	120	1,192	1,192	0
13	Benefits for former personnel				
	Severance pay	0	0	0	0
	Unemployment compensation	0	0	0	0
	Other	0	0	0	0
	Subtotal	0	0	0	0
21	Travel and transportation of persons				
	Common carrier	0	1	1	0
	Mileage	0	0	0	0
	Per diem/actual	0	1	1	0
	Other	0	0	0	0
	Subtotal	0	2	2	0
22	Transportation of things	1	9	9	0
23.1	Rental payments to GSA	0	0	0	0
23.2	Rental payments to others	0	0	0	0

	Object Class	2008 Adjustments to Base	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
23.3	Communications, utilities, and miscellaneous charges				
	Rental of ADP equipment	0	0	0	0
	Rental of office copying equipment	0	2	2	0
	Other equipment rental	0	16	16	0
	Federal telecommunications system	0	0	0	0
	Other telecommunications services	1	112	112	0
	Postal Service by USPS	0	3	3	0
	Utilities:				
	Electric	0	0	0	0
	Gas	0	0	0	0
	Water/Sewer	0	0	0	0
	Subtotal	1	133	133	0
24	Printing and reproduction				
	Publications	0	0	0	0
	Other	0	0	0	0
	Subtotal	0	0	0	0
25.1	Advisory and assistance services				
	Management & professional support services	0	0	0	0
	Studies, analyses, & evaluation	0	0	0	0
	Engineering & technical services	0	0	0	0
	Subtotal	0	0	0	0
25.2	Other services				
	Training	2	25	25	0
	ADP Services	0	0	0	0
	Other non-government contracts	(9,646)	32,692	32,692	0
	Subtotal	(9,644)	32,717	32,717	0
25.3	Purchases of goods and services from Government accounts				
	Payments to DM, WCF	0	0	0	0
	Office of Personnel Management	0	0	0	0
	Other Federal agencies:				
	Department of Commerce	1	2	2	0
	Other	6	13	13	0
	Subtotal	7	15	15	0

	Object Class	2008 Adjustments to Base	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
25.5	Research and development contracts	0	0	0	0
25.7	Operation and maintenance of equipment	12	2,934	2,934	0
26	Supplies and materials				
	Office & laboratory supplies	32	1,368	1,368	0
	Scientific publications & journals	0	0	0	0
	Fuel oil	0	0	0	0
	Subtotal	32	1,368	1,368	0
31	Equipment				
	Office machines and other equipment	1	4	4	0
	ADP equipment	1	125	125	0
	Equipment amortization	0	2	2	0
	Subtotal	2	131	131	0
32	Land and structures	(11,800)	4,287	51,287	$47,000
41	Grants, subsidies, and contributions	0	0	0	0
42	Insurance claims and indemnities	0	0	0	0
99	Total Obligations	(21,133)	46,865	93,865	47,000
	Less Prior Year Recoveries	0	0	0	0
	Less Unobligated Balance start of year	0	0	0	0
	Plus Unobligated Balance end of year	0	0	0	0
	Total Budget Authority	(21,133)	46,865	93,865	47,000
	Transfer to NIST Working Capital Fund	0	0	0	0
	Total Requirements	(21,133)	46,865	93,865	47,000

Exhibit 23

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Construction of Research Facilities
SUMMARY OF INFORMATION TECHNOLOGY RESOURCES
(Dollar amounts in thousands)
(Budget Authority)

IT Projects by Activity/Subactivity: (Totals by Activity)	Unique Project Identifier	IT Investment Title	2006 Actual	2007 Estimate	2008 Estimate	Increase/ Decrease
Construction and Major Renovations			$0	$0	$0	$0
Total			0	0	0	0

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Construction of Research Facilities
APPROPRIATION LANGUAGE AND CODE CITATIONS

1. For construction of new research facilities, including architectural and engineering design, and for renovation and maintenance of existing facilities, not otherwise provided for the National Institute of Standards and Technology, as authorized by 15 U.S.C. 278c-278e,

   15 U.S.C. 278c authorizes that the Secretary of Commerce to acquire land for such field sites as are necessary for the proper and efficient conduct of the activities authorized.

   15 U.S.C. 278d authorizes that the Secretary of Commerce to undertake such construction of buildings and other facilities and to make such improvements to existing buildings, grounds, and other facilities as are necessary for the proper and efficient conduct of authorized activities.

   15 U.S.C. 278e provides that in the performance of the functions of the National Institute of Standards and Technology the Secretary of Commerce is authorized to undertake: the care, maintenance, protection, repair, and alteration of Institute buildings and other plant facilities, equipment, and property.

2. $93,865,000, to remain available until expended.

no specific authority

Additional authorizing legislation will be proposed for FY 2008.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Construction of Research Facilities
ADVISORY AND ASSISTANCE SERVICES
(Obligations in thousands of dollars)

	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate
Management and professional support services	$2	0	0
Studies, analyses, and evaluations	0	0	0
Engineering and technical services	0	0	0
Total	2	0	0

Significant Activities

Professional support and engineering and technical services are obtained in support of the construction and major repairs renovations of NIST's physical infrastructures in Gaithersburg, Maryland, and Boulder, Colorado. Strategies and action plans are being developed to further ensure structural building safety.

Need for Advisory and Assistance Services

NIST uses outside professional support and engineering and technical services whenever necessary expertise is not available in-house to ensure the safety of NIST staff and visitors.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
SUMMARY OF RESOURCE REQUIREMENTS
(Dollar amounts in thousands)

	Positions	FTE	Budget Authority	Direct Obligations
Continuing Resolution, 2007	686	764	$750	$750
Increase in transfers to to support level in 2007 President's Budget			9,250	9,250
2008 Base	686	764	10,000	10,000
Transfer from STRS program changes for equipment investments			2,500	2,500
2008 Estimate	686	764	12,500	12,500

Exhibit 6

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
SUMMARY OF REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Comparison by activity:	2006 Estimate FTE	2006 Estimate Amount	2007 Continuing Resolution FTE	2007 Continuing Resolution Amount	2008 Base FTE	2008 Base Amount	2008 Estimate FTE	2008 Estimate Amount	Increase/ (Decrease) Over 2008 Base FTE	Increase/ (Decrease) Over 2008 Base Amount
NIST laboratories										
Laboratories and technical programs										
WCF transfer		$1,050		$200		$6,450		$7,950		$1,500
Reimbursables	705	167,452	749	156,458	749	131,862	749	131,862	0	0
WCF investments	0	13,902	0	2,401	0	0	0	0	0	0
Subtotal	705	182,404	749	159,059	749	138,312	749	139,812	0	1,500
National research facilities										
WCF transfer		250		550		3,550		4,550		1,000
Reimbursables	14	3,939	15	5,389	15	5,490	15	5,490	0	0
WCF investments	0	(51)	0	(420)	0	0	0	0	0	0
Subtotal	14	4,138	15	5,519	15	9,040	15	10,040	0	1,000
Baldrige national quality program										
WCF transfer		0		0		0		0		0
Reimbursables	0	2,809	0	3,064	0	3,400	0	3,400	0	0
WCF investments	0	(12)	0	4	0	0	0	0	0	0
Subtotal	0	2,797	0	3,068	0	3,400	0	3,400	0	0
Advanced technology program										
WCF transfer		0		0		0		0		0
Reimbursables	1	95	0	3	0	0	0	0	0	0
WCF investments	0	22	0	4	0	0	0	0	0	0
Subtotal	1	117	0	7	0	0	0	0	0	0

Comparison by activity:	2006 Estimate FTE	2006 Estimate Amount	2007 Continuing Resolution FTE	2007 Continuing Resolution Amount	2008 Base FTE	2008 Base Amount	2008 Estimate FTE	2008 Estimate Amount	Increase/ (Decrease) Over 2008 Base FTE	Increase/ (Decrease) Over 2008 Base Amount
Hollings manufacturing extension partnership										
WCF transfer		0		0		0		0		0
Reimbursables	0	612	0	1,420	0	94	0	94	0	0
WCF investments	0	15	0	9	0	0	0	0	0	0
Subtotal	0	627	0	1,429	0	94	0	94	0	0
Total, National Institute of Standards and Technology										
WCF transfer		1,300		750		10,000		12,500		2,500
Reimbursables	720	174,907	764	166,334	764	140,846	764	140,846	0	0
WCF investments	0	13,876	0	1,998	0	0	0	0	0	0
Grand Total	720	190,083	764	169,082	764	150,846	764	153,346	0	2,500

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
SUMMARY OF FINANCING
(Dollar amounts in thousands)

	2006 Estimate	2007 Continuing Resolution	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
Total Obligations	$190,083	$169,082	$150,846	$153,346	$2,500
Offsetting collections from:					
Federal funds	(118,400)	(124,469)	(99,164)	(99,164)	0
Non-Federal sources	(47,256)	(43,863)	(41,682)	(41,682)	0
Total offsetting collections	(165,656)	(168,332)	(140,846)	(140,846)	0
Unobligated balance, start of year	(154,725)	(131,598)	(131,598)	(131,598)	0
Unobligated balance, end of year	131,598	131,598	131,598	131,598	0
Budget Authority	1,300	750	10,000	12,500	2,500
Financing:					
Transfer from other accounts	(1,300)	(750)	(10,000)	(12,500)	(2,500)
Appropriation	0	0	0	0	0

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
JUSTIFICATION OF PROGRAM AND PERFORMANCE

Goal Statement

This Working Capital Fund (WCF) supports the NIST goal to promote innovation, facilitate trade and ensure public safety and security by strengthening the Nation's measurement and standards infrastructure, and the Department of Commerce strategic goal to promote U.S. innovation and industrial competitiveness by protecting intellectual property, enhancing technical standards, and advancing measurement science. The WCF reflects the full-time equivalent (FTE) employment and reimbursable obligations associated with the reimbursable work performed by NIST for other agencies and the public, and WCF investments.

Base Program

NIST's reimbursable services consist of technical work performed for other Federal agencies, state and local governments, and the private sector, including calibrations and special tests, advisory services, and the sale of Standard Reference Materials (SRMs). The unique measurement and standards expertise developed with appropriated funding gives NIST the capability to perform these services on a reimbursable basis. NIST accepts other agency work based on an established set of criteria which include: (1) the need for traceability of measurements to national standards; (2) the need for work which cannot or will not be addressed by the private sector; (3) work supported by legislation that authorizes or mandates certain services; (4) work which would result in an unavoidable conflict of interest if carried out by the private sector or regulatory agencies; and (5) requests by the private sector for NIST action or services.

The operations of the NIST WCF are reported in a program and financing schedule printed in the President's Budget, as well as reflected in the reimbursable amounts throughout this budget. In addition to its function as a revolving fund, the WCF is also used to handle annual leave on an accrued basis, to acquire equipment as an investment to be recovered through amortization charges to programs, to distribute indirect costs to programs as overhead, to carry the recoverable costs associated with the production of SRMs, and to carry supply inventories until issued for program use. A detailed cost accounting system is used to ensure that the actual cost of work performed for each job or task is recorded and identified with the appropriate source of financing.

Performance Measures

Data on NIST programmatic performance evaluation and reporting are provided in Exhibit 3A of this budget request.

Department of Commerce
Technology Adminstration
National Institute of Standards and Technology
Working Capital Fund
SUMMARY OF REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

	Object Class	2006 Actual	2007 Continuing Resolution	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
11	Personnel compensation					
11.1	Full-time permanent	0	0	0	0	0
11.3	Other than full-time permanent	0	0	0	0	0
11.5	Other personnel compensation	0	0	0	0	0
11.9	Total personnel compensation	0	0	0	0	0
12.1	Civilian personnel benefits	0	0	0	0	0
13	Benefits for former personnel	0	0	0	0	0
21	Travel and transportation of persons	0	0	0	0	0
22	Transportation of things	0	0	0	0	0
23.1	Rental payments to GSA	0	0	0	0	0
23.2	Rental payments to others	0	0	0	0	0
23.3	Communications, utilities, and miscellaneous charges	0	0	0	0	0
24	Printing and reproduction	0	0	0	0	0
25.1	Advisory and assistance services	0	0	0	0	0
25.2	Other services	0	0	0	0	0
25.3	Purchases of goods and services from Government accounts	0	0	0	0	0
25.5	Research and development contracts	0	0	0	0	0
25.7	Operation and maintenance of equipment	0	0	0	0	0
26	Supplies and materials	0	$550	$550	$550	0
31	Equipment	$1,300	200	9,450	11,950	$2,500
32	Land and structures	0	0	0	0	0
41	Grants, subsidies, and contributions	0	0	0	0	0
42	Insurance claims and indemnities	0	0	0	0	0
99	Total Obligations	1,300	750	10,000	12,500	2,500

Personnel Data	2006 Actual	2007 Continuing Resolution	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
Full-time equivalent employment:					
Full-time permanent	659	698	698	698	0
Other than full-time permanent	61	66	66	66	0
Total	720	764	764	764	0
Authorized Positions:					
Full-time permanent	633	666	666	666	0
Other than full-time permanent	18	20	20	20	0
Total	651	686	686	686	0

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
DETAILED REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

	Object Class	2008 Adjustments to Base	2008 Base	2008 Estimate	Increase/ (Decrease) Over 2008 Base
26	Supplies and materials				
	Office & laboratory supplies	0	$550	$550	0
	Other	0	0	0	0
	Subtotal	0	550	550	0
31	Equipment				
	Office machines and other equipment	0	9,200	11,700	$2,500
	ADP equipment	0	250	250	0
	Equipment amortization	0	0	0	0
	Subtotal	0	9,450	11,950	2,500
99	Total Obligations	0	10,000	12,500	2,500

Department of Commerce
Technology Administration
National Institute of Standards and Technology
NIST Working Captial Fund
SUMMARY OF INFORMATION TECHNOLOGY RESOURCES
(Dollar amounts in thousands)
(Budget Authority)

IT Projects by Activity/Subactivity: (Totals by Activity)	Unique Project Identifier	IT Investment Title	2006 Acutal	2007 Estimate	2008 Estimate	Increase/ Decrease
NIST Working Capital Fund						
	006-55-01-01-02-7011-00	Other Financial Systems	$697	$715	$735	$20
	006-55-01-26-01-7045-00	NIST Central IT Support for Sciene	3,143	3,226	3,323	97
	006-55-01-26-02-7021-00	NIST Laboratories	6,306	6,466	6,646	180
	006-55-02-00-02-7022-00	IT Infrastructure and Office Automation	21,779	22,299	22,841	542
	006-55-03-00-02-7023-00	Enterprise Architecture & Planning	201	206	210	4
	006-55-04-00-01-7080-00	Grants Management Information System	654	720	1,220	500
Total			32,780	33,632	34,975	1,343

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
ADVISORY AND ASSISTANCE SERVICES
(Obligations in thousands of dollars)

	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate
Management and professional support services	$425	$164	$66
Studies, analyses, and evaluations	1,024	200	50
Engineering and technical services	892	627	193
Total	2,341	991	309

Significant Activities

Advisory and assistance services funded by the Working Capital Fund represent services funded by reimbursable funds in support of reimbursable work conducted at NIST.

Need for Advisory and Assistance Services

Advisory and Assistance services have been necessary to obtain additional expertise for conducting activities like the technical evaluation of the World Trade Center collapses, for example.

Working Capital Fund, National Institute of Standards and Technology (NIST)

The operations of the NIST Working Capital Fund are reported in a program and financing schedule printed in the President's Budget, as well as reflected in the reimbursable amounts throughout this budget. The fund finances the initial costs of work performed by NIST and is reimbursed by applicable appropriations and advances or reimbursements from other agencies. A detailed cost accounting system is used to ensure that the actual cost of work performed for each job or task is recorded and identified with the appropriate source of financing. In addition to its function as a revolving fund, the Working Capital Fund is also used to handle annual and sick leave on an accrued basis, to acquire equipment as an investment to be recovered through amortization charges to programs, to distribute indirect costs to programs as overhead, to carry the recoverable costs associated with the production of Standard Reference Materials, and to carry supply inventories until issued for program use.

The table below summarizes the total NIST program, according to the source of financing. Following this table is a summary of the NIST reimbursable program by sponsor and source of support.

Summary of Total NIST Program
(Obligations in thousands)

	FY 2006			FY 2007			FY 2008			
Source and Use of Funds Spent	Perm. Pos. [1]	FTE	Oblig.	Perm. Pos. [1]	FTE	Oblig.	Perm. Pos. [1]	FTE	Oblig.	Approp. Requested
Direct Funding										
Scientific and technical research and services	1,844	1,774	$398,621	1,784	1,854	$402,976	2,006	2,020	$492,267	$500,517
Industrial technology services	184	201	183,879	96	125	119,760	48	72	52,487	46,332
Construction of research facilities	61	43	168,635	51	50	77,013	51	50	93,865	93,865
Gifts and bequests	0	0	13	0	0	13	0	0	13	0
Total, direct funding	2,089	2,018	751,148	1,931	2,029	599,762	2,105	2,142	638,632	640,714
Reimbursable Funding and WCF Investments										
Research, development and supporting services:										
Federal government	450	498	123,070	474	527	124,469	474	527	99,164	
Calibrations and tests, technical and advisory services:										
Federal government	17	19	4,975	18	20	4,279	18	20	4,255	
Public and non-federal government	97	107	27,591	102	114	23,728	102	114	23,593	
Subtotal, Services	114	126	32,566	120	134	28,007	120	134	27,848	
National Voluntary Laboratory Accreditation Program	19	21	4,602	20	23	5,056	20	23	5,056	
Standard reference materials (SRMs):										
SRM Sales:										
Federal government	2	2	250	2	2	197	2	2	197	
Public and non-federal government	66	73	10,865	70	78	8,605	70	78	8,581	
Subtotal, SRM sales	68	75	11,115	72	80	8,802	72	80	8,778	
SRM investment adjustment	0	0	3,554	0	0	0	0	0	0	
Subtotal, SRM	68	75	14,669	72	80	8,802	72	80	8,778	
Total, Reimbursable program	651	720	174,907	686	764	166,334	686	764	140,846	
WCF Investments and Operating Adjustments										
WCF investments	0	0	19,602	0	0	19,666	0	0	19,045	
WCF transfers	0	0	1,300	0	0	750	0	0	12,500	
WCF operating adjustments	0	0	12,054	0	0	0	0	0	0	
Total, WCF Investments and operating adjustments	0	0	32,956	0	0	20,416	0	0	31,545	
Total, NIST program	2,740	2,738	959,011	2,617	2,793	786,512	2,791	2,906	811,023	
Offsetting adjustment for amortization of equipment	0	0	(17,780)	0	0	(17,668)	0	0	(19,045)	
Adjusted total, NIST program	2,740	2,738	941,231	2,617	2,793	768,844	2,791	2,906	791,978	

[1] Most NIST scientists and engineers are not engaged solely on one research project. Individuals may divide their time between two or more projects financed by different sources of support. Also, salary costs of many staff members are charged to an overhead account and subsequently prorated to all directly funded projects. For these reasons, it is not possible to report employment directly for any source of financing. The Permanent Positions above are statistically-derived numbers, based on the estimated work years distribution for NIST programs.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
REIMBURSABLE PROGRAM AND WORKING CAPITAL FUND INVESTMENTS
(Dollar amounts in thousands)

	FY 2006 Actual	FY 2007 Continuing Resolution	FY 2008 Estimate
Department of Defense			
Air Force	$8,474	$9,780	$6,742
Army	2,456	2,340	1,928
Navy	2,353	1,802	1,745
Other	17,840	19,087	14,405
Subtotal, Department of Defense	31,123	33,009	24,820
Department of Agriculture	5	0	0
Department of Commerce	11,425	9,579	9,339
Department of Energy	4,511	5,060	3,827
Department of Health & Human Services	5,239	8,732	3,655
Department of Homeland Security	42,371	33,600	27,673
Department of Housing & Urban Development	565	600	600
Department of the Interior	110	153	145
Department of Justice	11,191	17,609	16,466
Department of State	926	1,104	901
Department of Transportation	2,189	2,357	1,538
Department of the Treasury	206	93	18
Department of Veterans Affairs	144	140	0
Environmental Protection Agency	1,766	1,022	920
General Services Administration	1,024	1,590	267
National Aeronautics & Space Administration	4,603	3,452	3,316
National Science Foundation	3,423	4,335	4,262
Nuclear Regulatory Commission	342	250	265
Other	1,907	1,784	1,152
Subtotal, Federal Agencies	123,070	124,469	99,164
Calibrations & Testing	8,889	8,244	8,339
Technical & Advisory Services	28,279	24,819	24,565
Standard Reference Materials	14,669	8,802	8,778
Subtotal, Other Reimbursables	51,837	41,865	41,682
Total, Reimbursable Program	174,907	166,334	140,846
Equipment Transfers	1,300	200	11,950
Reactor Fuel Transfers	0	550	550
Subtotal, WCF transfer	1,300	750	12,500
Equipment Investments	19,602	19,666	19,045
IE Amortization	(17,780)	(17,668)	(19,045)
WCF Operating Adjustments	12,054	0	0
Total, WCF Investments	13,876	1,998	0
Total, Reimbursable Program and WCF Investments	190,083	169,082	153,346

Department of Commerce
Technology Administration
National Institute of Standards and Technology
PERIODICALS, PAMPHLETS, AND AUDIOVISUAL SERVICES
(Obligations in thousands)

	2005 Actual	2006 Actual	2007 Estimate	2008 Estimate
Periodicals	$26	$30	$34	$34
Pamphlets	3	14	39	39
Audiovisuals	0	0	0	0
Total	29	44	73	73

The National Institute of Standards and Technology produces only one periodical - The Journal of Research. *The Journal of Research of the National Institute of Standards and Technology,* issued six times a year, reports NIST research and development in those disciplines of the physical and engineering sciences in which NIST is active (physics, chemistry, engineering, mathematics, and computer sciences).

Department of Commerce
Technology Administration
National Institute of Standards and Technology
AVERAGE SALARY

	2006 Actual	2007 Estimate	2008 Estimate
Average ES salary	$152,341	$155,693	$160,364
Average scientific and professional (P.L. 80-313)	150,228	153,533	158,139
Average Career Path Salary	93,037	95,084	97,937
Average salary of ungraded positions	48,698	49,769	51,262

Exhibit 36

Department of Commerce
Technology Administration
National Technical Information Service
NTIS Revolving Fund
AVERAGE GRADE AND SALARIES

	2006 Actual	2007 Estimate	2008 Estimate
Average GS/GM Grade	10.5	10.7	10.9
Average GS/GM Salary	$72,366	$77,400	$82,400