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National Institute of Standards and Technology
U.S. Department of Commerce

FY 2017 Congressional Budget Request

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National Institute of Standards and Technology
U.S. Department of Commerce

FY 2017 Congressional Budget Request

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NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

NATIONAL TECHNICAL INFORMATION SERVICE

FISCAL YEAR 2017
BUDGET SUBMISSION TO CONGRESS

Exhibit 1

Department of Commerce
National Institute of Standards and Technology
BUDGET ESTIMATES, FISCAL YEAR 2017
CONGRESSIONAL SUBMISSION

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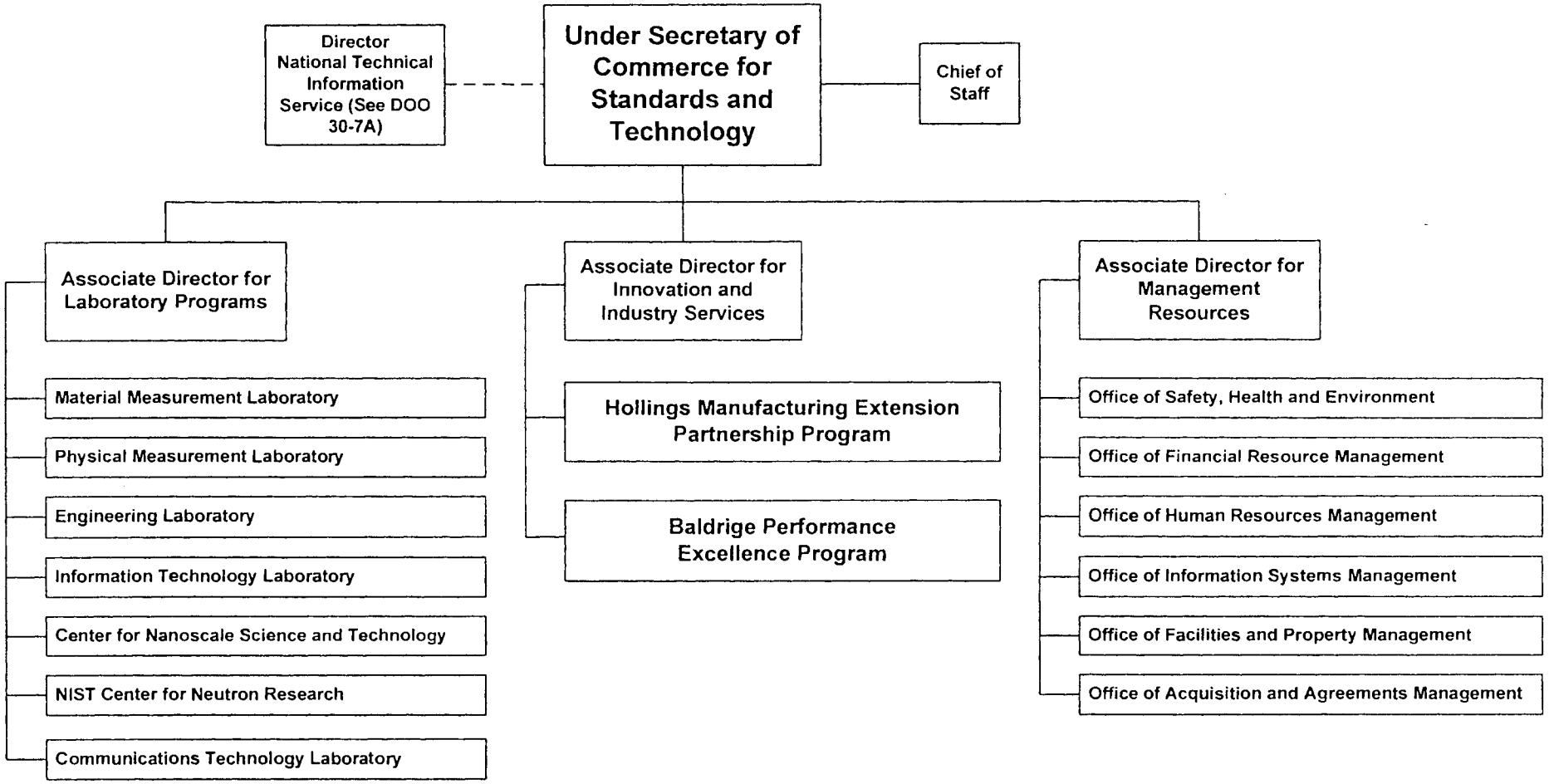

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EXECUTIVE SUMMARY

General Statement

The National Institute of Standards and Technology (NIST) 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. For more than 110 years, NIST has maintained the national standards of measurement, a role that the U.S. Constitution assigns to the federal government to ensure fairness in the marketplace. Today, the NIST Laboratories address increasingly complex measurement challenges, ranging from the very small (nanoscale devices) to the very large (vehicles and buildings), and from the physical (renewable energy sources) to the virtual (cybersecurity and cloud computing). As new technologies develop and evolve, NIST's measurement research and services remain central to innovation, productivity, trade, and public safety. NIST promotes the use of measurements based on the international system of units (SI). The measurement science research at NIST is useful to all science and engineering disciplines.

Additionally, NIST's portfolio includes the Hollings Manufacturing Extension Partnership (MEP) and the National Network for Manufacturing Innovation (NNMI). MEP is a federal-state-industry partnership which provides U.S. manufacturers with access to technologies, resources, and industry experts. The program consists of Manufacturing Extension Partnership Centers located across the country that work directly with their local manufacturing communities to strengthen the competitiveness of our nation's domestic manufacturing base. Funding for the MEP Centers is a cost-sharing arrangement consisting of support from the federal government, state and local government/entities, and fees charged to the manufacturing clients for services provided by the MEP Centers. The NNMI will serve to create an effective manufacturing research infrastructure for U.S. industry and academia to solve industry-relevant problems.

In FY 2017, NIST will continue to execute mandatory resources provided in FY 2015 through the NIST Public Safety Communications Research Fund to help develop cutting-edge wireless technologies for public safety users, as part of the National Wireless Initiative included in the Middle Class Tax Relief and Job Creation Act of 2012.

NIST is a critical agency for implementing the Department's "Innovation" strategic goal and objectives. As stated in the Department's Strategic Plan for FY 2014-2018, "Innovation is the key driver of U.S. competitiveness. The Department is well-positioned to address many of the challenges the country faces in the manufacturing sector. Through the NIST, the Department houses foundational research capabilities that accelerate the development and adoption of technological breakthroughs that help grow the economy. Increasingly the Department uses its unique convening power to promote public-private partnerships among universities and businesses. These partnerships provide scientific and technical resources to manufacturing firms, and support a skilled workforce to fill the manufacturing jobs of the 21st century." NIST also contributes to the Environment and Data strategic goals and objectives of the Department's strategic plan.

For FY 2017, NIST is submitting a total discretionary request level of roughly $1.0 billion, an increase of $50.5 million from the FY 2016 enacted level. Also included at this request level is a $14.9 million increase for inflationary cost changes. The following is a comparison of NIST's FY 2017 discretionary request level with the FY 2016 enacted level.

Appropriation	(Dollar amounts in millions) FY 2016 Enacted		FY 2017 Budget Request		Change from FY 2016	
	FTE	Amount	FTE	Amount	FTE	Amount
Scientific and Technical Research and Services	2,477	$690.0	2,523	$730.5	46	$40.5
Industrial Technology Services	97	155.0	96	189.0	(1)	34.0
Construction of Research Facilities	120	119.0	120	95.0	0	(24.0)
Working Capital Fund	689	0.0	689	0	0	0
TOTAL DISCRETIONARY RESOURCES	**3,383**	**964.0**	**3,428**	**1,014.5**	**45**	**50.5**
National Network for Manufacturing Innovation *Mandatory*	0	0	0	1,890.0	0	1,890.0
NIST Public Safety Communications Research Fund	18	7.3[1]	27	0	9	(7.3)
Construction of Research Facilities *Mandatory*	0	0	0	100.0	0	100.0
TOTAL RESOURCES	**3,401**	**971.3**	**3,455**	**3,004.5**	**54**	**2,033.2**

[1] Excludes offsetting collection of $92.7 million unobligated at the end of FY 2015.

Goals of the Program and Statement of Objectives

DISCRETIONARY APPROPRIATIONS

Scientific and Technical Research and Service (STRS) Appropriation

The objectives of the STRS programs are to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology that drive technological change. NIST resources are devoted to meeting today's economic and societal challenges and laying the foundation for future success. NIST activities help address a broad range of critical science and innovation challenges for the nation. NIST's Laboratories funded by STRS play a unique role in the nation's scientific, industrial, and business communities. NIST anchors the national measurement and standards system that is the language of research and commerce. NIST's presence and leadership in the nation's measurement and standards system enables companies, researchers, government agencies, and universities to work with each other more easily, thereby improving the nation's economic security and quality of life. NIST also supports enacted legislation such as the America COMPETES Act, which outlines major roles for NIST in promoting national competitiveness and innovation, and Departmental priorities as described in the FY 2014–2018 Strategic Plan.

The NIST laboratory programs funded by STRS appropriations provide industry, academia, and other federal agencies with:

• Scientific underpinnings for basic and derived measurement units, international standards, measurement and calibration services, and certified reference materials;

• Impartial expertise and leadership in basic and applied research to enable development of test methods and verified data to support the efficient commercialization and exchange of goods and services in industry and commerce;

• Expertise and support for the development of consensus-based standards and specifications that define technical and performance requirements for goods and services, with associated measurements and test methods for conformity; and,

• Unique, cutting-edge user facilities that support innovation in materials science, nanotechnology discovery and fabrication, and other emerging technology areas through the NIST Center for Neutron Research (NCNR), which provides world-class neutron measurement capabilities to the U.S. research community, and the NIST Center for Nanoscale Science and Technology, which supports the U.S. nanotechnology enterprise from discovery to production by providing access to world-class nanoscale measurement and fabrication methods and technology.

FY 2017 STRS

NIST's FY 2017 request continues to support NIST's laboratory programs in creating the conditions for economic growth and opportunity by requesting $730.5 million for the STRS appropriation, a $40.5 million increase from FY 2016. This increase funds inflationary adjustments and seven program increases.

Construction of Research Facilities (CRF) Appropriation

This appropriation supports the construction of new facilities and the renovation and maintenance of NIST's current buildings and laboratories to comply with scientific and engineering requirements and to keep pace with federal, state, and local health and safety regulations. The CRF request totals roughly $95.0 million, and includes $40.0 million for the renovation of NIST Building 245.

Industrial Technology Services (ITS) Appropriation

The President's Budget request is $189.0 million for the Industrial Technology Services appropriation, which consists of two programs, the Hollings Manufacturing Extension Partnership (MEP) and the National Network for Manufacturing Innovation (NNMI) Program. The request is a $34.0 million increase from FY 2016.

FY 2017 ITS

Hollings Manufacturing Extension Partnership (MEP)

The request includes $142.0 million for MEP, a $12.0 million increase from FY 2016. This amount includes $1.0 million for inflation increase adjustments. MEP is a federal-state-industry partnership that provides U.S. manufacturers with access to technologies, resources, and industry experts. The program consists of 58 MEP Centers that work directly with their local manufacturing communities to strengthen the competitiveness of our nation's domestic manufacturing base. MEP supports the mission of NIST and the Department of Commerce to promote U.S. innovation and competitiveness and enable economic growth for American industries, workers, and consumers. Services provided by MEP are grounded in technology-related activities, sustainability, efficiencies through continuous improvement, and new product development and market diversification. In FY 2013, MEP began a broad based strategic planning process and developed an operational reform agenda intended to optimize program effectiveness, enhance administrative efficiency, and provide greater financial accountability. In FY 2014, MEP initiated a reform of the national system of MEP centers through a systematic, multi-year series of full and open competitions. MEP has completed the first two rounds of center competitions in 20 states in response to GAO recommendations which has thus far resulted in centers focusing more on assisting very small, rural, and start-up manufacturing companies, and more cash rather than in-kind match to the federal dollar investment from state and local partners. These re-competition efforts are ongoing and will continue in FY 2017.

National Network for Manufacturing Innovation (NNMI)

The request provides funds for federal investment in the National Network for Manufacturing Innovation Program, which serves to create an effective manufacturing research infrastructure for U.S. industry and academia to solve industry-relevant problems. The NNMI consists of linked Institutes for Manufacturing Innovation with common goals, but unique concentrations. In an institute, industry, academia, and government partners leverage existing resources, collaborate, and co-invest to nurture manufacturing innovation and accelerate commercialization. As sustainable manufacturing innovation hubs, the institutes will create, showcase, and deploy new capabilities, new products, and new processes that can impact commercial production. They will build workforce skills at all levels and enhance manufacturing capabilities in companies large and small. Institutes will draw together the best talents and capabilities from all the partners to

build the proving grounds where innovations flourish and help advance American domestic manufacturing. The request includes $47.0 million in discretionary funds for the program. $42.0 million of the request is for, creation and support of three institutes on topics proposed by industry, and the remaining $5.0 million for efficient coordination among all institutes stood up by Commerce and other agencies.

In addition to the aforementioned $47.0 million request in discretionary funds for NNMI, the NIST Budget calls for $1.9 billion in mandatory funds to fully fund a network of 45 Institutes by FY 2025.

FY 2017 CRF

The request totals roughly $95.0 million. Within this total, base funds of $40.0 million will continue the multi-year effort to renovate and modernize the Radiation Physics Building 245. The FY 2017 funding will allow NIST to begin the next phase of a multi-phased project for the Building 245 Modernization (B245M), specifically the construction of a D Wing addition, excavation and waterproofing of existing subterranean laboratory spaces in the B, C, and D Wings, and to begin the replacement of the failing B, C, and D Wing environmental and mechanical systems. This funding will allow the continued migration of research requiring strict environmental tolerances (temperature, humidity and air filtration) from antiquated space to modern facilities. This phase will incorporate the addition of approximately 9,000 gross square feet (gsf) of modern laboratory space and approximately 9,000 gsf of new consolidated mechanical/infrastructure support space with new mechanical equipment as well as controls to provide the much needed tighter environmental controls. This funding also incorporates the correction of a portion of the chronic water infiltration problem in the basement and sub-basement laboratories.

Summary of Proposed Changes

1. Measurement Science for Future Computing Technologies and Applications (+$13.6 million and +19 FTE)

As a lead agency in the National Strategic Computing Initiative NIST will:

- Enable the design, assessment, and operation of advanced devices, materials, and concepts such as precise placement of individual atoms, new fabrication methods, new imaging methods for complex structures, and system parts for superconducting computers.

- Develop measurements and prototype devices to support alternative computational paradigms including quantum computers and computers capable of brain-like sensing.

- Create standard frameworks for uncertainty quantification in scientific computing, and establishing a calibration framework for modeling and simulation.

2. Advanced Sensing for Manufacturing (+$2.0 million and +5 FTE)

NIST will accelerate research efforts targeting the development of advanced sensors needed to support the manufacture of advanced electronics and nanoengineered devices.

3. Biomanufacturing/Engineered Biology: Developing Engineering Principles for Efficient Biomanufacturing (+$2.0 million and +3 FTE)

NIST will expand research programs that will develop the measurement tools to support advanced biomanufacturing.

4. Advanced Communications – Addressing the Spectrum Crunch (+$2.0 million and +4 FTE)

New efforts in FY 2017 will further the efforts of the NIST Communications Technology Laboratory to revolutionize public safety communications and increase the nation's communications capacity through measurement and evaluation of new spectrum sharing technologies, and the development of measurements to advance next-generation 5G wireless networks and optical fiber communications.

5. Ensuring a World Class Neutron Research Facility (+$4.8 million and 0 FTE)

NIST requires new funding to procure additional reactor fuel to keep the NIST Center for Neutron Research operational. The Center serves over 2,000 researchers from around the world each year.

6. Lab to Market/Technology Transfer: Expand Technology Transfer Activities to Leverage Existing Authorities to Promote Data Sharing Efforts (+$2.0 million and 0 FTE)

This initiative will strengthen technology transfer efforts across the government through the creation of a collaborative digital platform to facilitate sharing and synchronization of tech transfer data across agencies.

7. Departmental Working Capital Fund Increase (+$0.995 million and 0 FTE)

This increase will cover additional shared service investments within the Departmental Working Capital Fund (WCF). These Departmental requirements include necessary investments in Department-wide systems, network security initiatives and replacement of degrading IT infrastructure. A full discussion of all WCF program changes can be found in the WCF section of the Departmental Management.

8. Hollings Manufacturing Extension Partnership (MEP) Program (+$11.1 million and 0 FTE)

The funding will increase the capacity of the MEP centers allowing them to work with additional manufacturers, including small and rural companies. MEP estimates increasing the number of clients receiving MEP services by over 60 percent over the next three years. In addition, MEP will generate additional economic impact as a result of this increased investment, resulting in an additional $1.3 billion in new and retained sales, $500.0 million in new investment, $200.0 million in cost savings, and nearly 13 thousand new and retained jobs.

9. National Network for Manufacturing Innovation (NNMI) (+$22.0 million and +1 FTE)

The President's FY 2017 Budget request will enable NIST to establish two new Manufacturing Innovation institutes through open competition to address industry identified research and development challenges where a collaborative effort will strengthen the U.S. Advanced Manufacturing Infrastructure.

10. NIST Building 245 Renovations (+$40.0 million and 0 FTE)

The FY 2017 request will provide the necessary resources to continue the renovation of NIST Building 245 that was begun in FY 2016. These funds will begin to address major systemic issues with the existing structure, such as water intrusion and inadequate environmental controls, which currently cause unpredictable delays in NIST calibrations and inhibit research. Building 245 is a mission critical facility that supports services relied on by industry (including 39 million mammograms per year which are traceable to this facility) and federal agency partners including: Department of Homeland Security (DHS), National Aeronautics and Space Administration (NASA), Defense Advanced Research Projects Agency (DARPA), National Oceanic and Atmospheric Administration (NOAA), and the Federal Drug Administration (FDA).

MANDATORY FUNDING

National Network for Manufacturing Innovation (NNMI)

In addition to the aforementioned $47.0 million request in discretionary funds for NNMI, NIST proposes $1.9 billion in mandatory funds to fully fund a network of 45 institutes by FY 2025.

Construction of Research Facilities (CRF)

In addition to the $95.0 million request in discretionary funds for CRF, authorizing legislation will be proposed that would provide $100.0 million in mandatory funds to renovate and modernize NIST facilities in order to maintain and enhance current research and development capabilities. This additional investment to renovate R&D facilities, is mandatory funding, because the discretionary levels set by the Bipartisan Budget Act are not sufficient for the nation to take full advantage of the opportunities for R&D investments to create jobs and grow the economy. Mandatory funding is presented in the FY 2017 Budget throughout the Federal R&D enterprise to support research across a range of topics from health to clean energy technologies, reflecting the high priority of R&D in a time of limited discretionary funding.

NIST Public Safety Communications Research Fund (PSCRF)

As stated previously, in FY 2017, NIST will continue to execute mandatory resources provided in FY 2015 through the NIST Public Safety Communications Research Fund to help develop cutting-edge wireless technologies for public safety users, as part of the National Wireless Initiative included in the Middle Class Tax Relief and Job Creation Act of 2012. This Act provides approximately $285.0 million in mandatory funds for NIST from the spectrum auction proceeds in FY 2015 to help industry and public safety organizations conduct research and develop new standards, technologies and applications to advance public safety communications in support of the initiative's efforts to build an interoperable nationwide broadband network for first responders.

Working Capital Fund

The Working Capital Fund finances research and technical services performed for other government agencies and the public. These activities are funded through advances and reimbursements. The Fund also finances the acquisition of equipment, standard reference materials, and storeroom inventories until issued or sold.

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 by NIST gives them the capability to perform these services on a reimbursable basis. NIST accepts other agency work based on an established set of criteria which include: the need for traceability of measurements to national standards; the need for work that cannot or will not be addressed by the private sector; work supported by legislation that authorizes or mandates certain services; work that would result in an unavoidable conflict of interest if carried out by the private sector or regulatory agencies; and requests by the private sector for NIST action or services. NIST's reimbursable program is estimated to be $168.9 million in FY 2016 and $150.3 million in FY 2017.

Scientific and Technical
Research and Services

Exhibit 5

Department of Commerce
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
2016 Enacted	2,481	2,477	$695,500	$719,428	$690,000
less: Unobligated balance from prior year	0	0	0	(22,928)	0
less: Transfers from DoJ	0	0	(4,500)	(4,500)	0
less: Transfer from EAC	0	0	(1,500)	(1,500)	0
2017 Adjustments to base:					
Annualization of positions financed in FY 2016	0	15			
plus: Restoration of 2016 deobligation offset	0	0	1,000	0	1,000
plus: Adjustment of WCF transfer for prior program changes	0	0	500	500	0
plus: Inflationary cost changes	0	0	13,163	13,163	13,163
less: Estimated recoveries, 2017	0	0	(1,000)	0	(1,000)
2017 Base Request	2,481	2,492	703,163	704,163	703,163
plus: 2017 Program changes	41	31	26,870	26,870	27,370
plus: Transfer from DoJ			2,999	2,999	0
plus: Transfer from EAC			1,500	1,500	0
2017 Estimate	2,522	2,523	734,532	735,532	730,533

		2015 Actual		2016 Enacted		2017 Base		2017 Estimate		Increase/ (Decrease) Over 2017 Base	
Comparison by program/sub-program:		Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount
Measurement science, services, and programs											
Laboratory programs	Pos./Approp	2,179	$591,305	2,248	$605,156	2,248	$613,435	2,289	$638,682	41	$25,247
	FTE/Obl.	2,143	602,156	2,238	621,484	2,253	614,295	2,284	640,542	31	26,247
Corporate services	Pos./Approp	43	17,311	43	17,311	43	21,262	43	21,285	0	23
	FTE/Obl.	42	17,328	43	17,475	43	21,365	43	21,388	0	23
Standards coordination and special programs	Pos./Approp	190	66,884	190	67,533	190	68,466	190	70,566	0	2,100
	FTE/Obl.	188	77,967	196	80,469	196	68,503	196	73,602	0	5,099
TOTALS	Pos./Approp	2,412	675,500	2,481	690,000	2,481	703,163	2,522	730,533	41	27,370
	FTE/Obl.	2,373	697,451	2,477	719,428	2,492	704,163	2,523	735,532	31	31,369

Comparison by program/sub-program:	2015 Actual Personnel	2015 Actual Amount	2016 Enacted Personnel	2016 Enacted Amount	2017 Base Personnel	2017 Base Amount	2017 Estimate Personnel	2017 Estimate Amount	Increase/ (Decrease) Over 2017 Base Personnel	Increase/ (Decrease) Over 2017 Base Amount
Adjustments for:										
Recoveries		(5,327)		(1,000)		(1,000)		(1,000)		0
Refunds		(53)		0		0		0		0
Unobligated balance, start of year		(33,551)		(22,928)		0		0		0
Unobligated balance, end of year		22,928		0		0		0		0
Unobligated balance, expired account		2		0		0		0		0
Budget Authority		681,450		695,500		703,163		734,532		31,369
Financing from transfers:										
Transfers to other accounts		450 [1/]		500		0		500		500
Transfers from DoJ for forensic sciences and OLES		(4,500)		(4,500)		0		(2,999)		(2,999)
Transfer from Election Assistance Commission		(1,900)		(1,500)		0		(1,500)		(1,500)
Appropriation		675,500		690,000		703,163		730,533		27,370

[1/] $450K transferred to the Department's DM WCF for HCHB renovation.

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

	2015 Actual	2016 Enacted	2017 Base	2017 Estimate	Increase/ (Decrease) Over 2017 Base
Total Obligations	$697,451	$719,428	$704,163	$735,532	$31,369
Offsetting collections from:					
Federal funds	0	0	0	0	0
Non-Federal sources	0	0	0	0	0
Total offsetting collections	0	0	0	0	0
Adjustments for:					
Recoveries and refunds	(5,380)	(1,000)	(1,000)	(1,000)	0
Unobligated balance, start of year	(33,551)	(22,928)	0	0	0
Unobligated balance, end of year	22,928	0	0	0	0
Unobligated balance, expired	2	0	0	0	0
Budget Authority	681,450	695,500	703,163	734,532	31,369
Financing:					
Transfer to other accounts	450 [1/]	500	0	500	500
Transfers from other accounts	(6,400) [2/]	(6,000) [2/]	0	(4,499) [2/]	(4,499)
Appropriation	675,500	690,000	703,163	730,533	27,370

[1/] $450K transferred to the Department's DM WCF for HCHB renovation.

[2/] Transfers of $1,900K from EAC and $4,500K from DOJ in FY 2015; transfers of $1,500K from EAC and $4,500K from DOJ in FY 2016; and planned transfers of $1,500K from EAC and $2,999K from DOJ in FY 2017.

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Exhibit 9

Department of Commerce
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 2016 deobligation offset	0	1,000

In FY 2016, 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 2017.

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

NIST's FY 2017 STRS budget authority is reduced by the estimated level of prior year deobligations in FY 2017.

Other Changes:

Annualization of 2016 pay raise		0	1,020

A pay raise of 1.3 percent is assumed to be effective January 1, 2016.

Total cost in FY 2017 of 2016 pay raise	$4,078,667
Less amount requested in FY 2016	(3,059,000)
Less amount absorbed in FY 2016	0
Amount requested in 2017 to provide full-year cost of 2016 pay raise	1,019,667

2017 Pay increase and related costs		0	3,957

A general pay raise of 1.6 percent is assumed to be effective January 1, 2017.

Total cost in FY 2017 of pay increase	$3,957,000
Less amount absorbed in FY 2017	0
Amount requested for FY 2017 pay increase	3,957,000
Payment to Departmental Management Working Capital Fund	0
Total adjustment for FY 2017 pay increase	3,957,000

Annualization of positions financed in FY 2016		15	0

NIST requires an additional 15 FTE to staff FY 2016 requested increases at their full operating level in FY 2017.

New positions in 2016	69
Less 5 percent lapse	(3)
Full-Year FTE	66
Less FTE Funded in 2016	(51)
Annualization of Positions/FTE in 2017	15

Change in compensable days	0	(2,499)

The decreased cost of one less compensable day in FY 2017 compared to FY 2016 is calculated by dividing the FY 2016 estimated personnel compensation ($263,706,000) and applicable benefits ($63,650,000) by 262 compensable days. The cost decrease of two less compensable days is $2,498,901.

Personnel benefits		$3,001
Civil Service Retirement System (CSRS)	($479)	
Federal Employees' Retirement System (FERS)	2,031	
Thrift Savings Plan (TSP)	342	
Federal Insurance Contribution Act (FICA) - OASDI	653	
Health Insurance	558	
Employees Compensation Fund	(104)	

Civil Service Retirement System (-$479,000) – 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 4.9 percent in FY 2016 to 2.3 percent in FY 2017. The contribution rate will remain at 7.0 percent in FY 2017.

Payroll subject to retirement systems ($263,442,294)	
Cost of CSRS contributions in FY 2017 ($263,442,294 x .023 x .07)	$424,142
Cost of CSRS contributions in FY 2016 ($263,442,294 x .049 x .07)	903,607
Total adjustment to base	(479,465)

Federal Employees' Retirement System ($2,031,000) – 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 95.1 percent in FY 2016 to 97.7 percent in FY 2017. P.L. 112-240 enacted in January 2013 modified the federal retirement annuity establishing a Revised Annuity Employee (RAE) reducing the amount of government FERS contribution percentage for those employees hired after January 1, 2013 with less than five years of creditable service.

Payroll subject to retirement systems ($232,858,480) (non-RAE employees)	
Basic benefit cost in FY 2017 ($232,858,480 x .977 x .137)	$31,167,875
Basic benefit cost in FY 2016 ($232,858,480 x .951 x .132)	29,231,191
Increase (FY 2016-FY 2017)	1,936,684
Payroll subject to retirement systems ($30,583,814) (RAE employees)	
Basic benefit cost in FY 2017 ($30,583,814 x .977 x .119)	$3,555,766
Basic benefit cost in FY 2016 ($30,583,814 x .951 x .119)	3,461,140
Increase (FY 2016-FY 2017)	94,626
Total adjustment to base	2,031,310

Thrift Savings Plan ($342,000) – The cost of agency contributions to the TSP will also rise as FERS participation increases. The contribution rate will increase from 4.62 percent to 4.63 percent in FY 2017.

Thrift plan cost in FY 2017 ($263,442,294 x .977 x .0463)	$11,916,839
Thrift plan cost in FY 2016 ($263,442,294 x .951 x .0462)	11,574,653
Total adjustment to base	342,186

Federal Insurance Contributions Act (FICA) - OASDI ($653,000) – As the percentage of payroll covered by FERS rises, the cost of OASDI contributions will increase. In FY 2017, the maximum salary subject to OASDI tax is $126,200. The OASDI tax rate for employers also remains at 6.2 percent in FY 2017.

FERS payroll subject to FICA tax in 2017 ($263,442,294 x .977 x .920 x .062)	$14,681,133
FERS payroll subject to FICA tax in 2016 ($263,442,294 x .951 x .904 x .062)	14,041,908
Increase (FY 2016-FY 2017)	639,225

OTP payroll subject to FICA tax in FY 2017 ($5,602,706 x .977 x .920 x .062)	312,228
OTP payroll subject to FICA tax in FY 2016 ($5,602,706 x .951 x .904 x .062)	298,633
Increase (FY 2016-FY 2017)	13,595
Total adjustment to base	652,820

Health insurance ($558,000) – Effective January 2015, NIST's contribution to Federal employees' health insurance premiums increased by 2.9 percent. Applied against the FY 2016 estimate of $19,228,000, the additional amount required is $557,612.

Employees' Compensation Fund (-$104,000) – The Employees' Compensation Fund bill for the year ending June 30, 2013, is $104,000 less than for the year ending June 30, 2012.

Mileage 0 1

The mileage reimbursement rate for privately-owned automobiles increased from 56 cents to 57.5 cents per mile effective January 1, 2015 for an increase of 2.7%. This percentage was applied to the FY 2016 estimate of $19,000 to arrive at an adjustment to base of $513.

Rental Payments to GSA 0 4

GSA rates are projected to be 3.0 percent in FY 2017 after economic adjustments. This percentage was applied to the FY 2016 estimate of $120,000 to arrive at an adjustment to base of $3,600.

Communications, utilities, and miscellaneous charges 0 (1,233)

Postage.....	1
Electricity rate decrease.....	(1,384)
Natural Gas rate increase.....	150

On January 15, 2015, the Governors of the Postal Service implemented a rate increase for shipping services. The overall price change is 2.0 percent. When applied to the FY 2016 postage estimate of $52,000, this results in an increase of $1,040.

The electricity ATB amount was derived using a year to year comparison of the cost per kilowatt hour. In analyzing the 12 months ended February 2015 and 2014, the per kilowatt hour rate decreased 6.0 percent (from .120 to .113) for Gaithersburg, Maryland; increased 1.0

percent (from .077 to .078) for Boulder, Colorado; and decreased 9.3 percent (from .106 to .096) for Ft. Collins, Colorado for a net decrease of $1,384,000.

The natural gas ATB amount was derived using a year to year comparison of the average cost per therm. In analyzing the 12 months ended February 2015 and 2014, the per therm rate remained at .456 per therm and increased 10.3 percent (from .597 to .659) for Gaithersburg and Boulder respectively resulting in a net increase of $150,000.

Other Services		0	5,455
Data Systems Maintenance Costs	$851		
Commerce Business Systems	3,804		
Working Capital Fund (Departmental Management)	478		
National Archives and Records Administration (NARA)	(22)		
Federal Protective Services	344		

Data Systems Maintenance Costs ($851,400) - This adjustment to base addresses the requirement to maintain the level of effort required for the networking, security, storage, and site maintenance costs associated with Administration Policy Directives OMB Memo M-10-06 Open Government Directive, and OMB Memo M-13-13 Open Data Policy, which require NIST to make scientific data and publications more accessible to the general public.

Commerce Business Systems (CBS) ($3,804,000) – An increase of $3,804,000 is required in FY 2017 consistent with the CBS Capital Asset Plan.

Working Capital Fund (Departmental Management) ($478,000) – An additional $478,000 is required to fund cost increases in the Departmental Management Working Capital Fund.

National Archives and Records Administration (-$22,000) – NARA estimates reflect a decrease of $22,000 in FY 2017 for records storage and maintenance costs.

Federal Protective Services ($344,000) – On July 21, 2015, the Department of Homeland Security announced that there would be an increase to the Federal Protective Service costs beginning in FY 2017. For NIST, the increase amounts to $344,000.

Supplies and Materials		0	267
Scientific journal subscriptions	$267		

Scientific journal subscriptions ($267,000) - This adjustment to base addresses the FY 2014 to FY 2015 inflationary increase in costs for NIST's subscriptions journals which exceed the inflationary increases provided through the regular general pricing level deflator. The application of the 7.1 percent deflator results in an increase of $266,889 when applied to the FY 2016 estimate of $3,759,000.

General pricing level adjustment		0	3,190

This request applies the OMB economic assumption of 1.8 percent for FY 2017 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 $21,510; rental payments to others $33,084; communications, utilities, and miscellaneous charges $57,816; printing and reproduction $9,180; other services $1,472,616; supplies and materials $591,732; and equipment $1,002,834.

Subtotal, Other changes		15	13,163
Total, Adjustments to base		15	13,163

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

Program: Measurement science, services, and programs
Sub-program: Laboratory programs

Line Item		2015 Actual Personnel	2015 Actual Amount	2016 Enacted Personnel	2016 Enacted Amount	2017 Base Personnel	2017 Base Amount	2017 Estimate Personnel	2017 Estimate Amount	Increase/ (Decrease) over 2017 Base Personnel	Increase/ (Decrease) over 2017 Base Amount
Strategic and emerging	Pos./Approp	26	$15,598	26	$12,324	26	$12,414	26	$12,435	0	$21
research initiative fund	FTE/Obl.	25	10,801	26	16,708	26	12,414	26	12,435	0	21
National measurement and	Pos./Approp	1,795	484,289	1,864	500,172	1,864	507,320	1,901	525,348	37	18,028
standards laboratories	FTE/Obl.	1,766	497,710	1,854	510,066	1,869	507,968	1,897	526,996	28	19,028
User facilities	Pos./Approp	254	80,390	254	80,819	254	81,507	258	88,689	4	7,182
	FTE/Obl.	250	81,341	254	82,192	254	81,705	257	88,887	3	7,182
Postdoctoral research	Pos./Approp	104	11,028	104	11,841	104	12,194	104	12,210	0	16
associateship program	FTE/Obl.	102	12,304	104	12,518	104	12,208	104	12,224	0	16
Total	Pos./Approp	2,179	591,305	2,248	605,156	2,248	613,435	2,289	638,682	41	25,247
	FTE/Obl.	2,143	602,156	2,238	621,484	2,253	614,295	2,284	640,542	31	26,247

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

	FY 2015 Actual	FY 2016 Enacted	FY 2017 Estimate
Department of Defense			
Air Force	$10,359	$6,470	$6,440
Army	469	831	950
Navy	627	1,649	1,477
Other, Department of Defense	15,945	15,311	13,713
Subtotal, Department of Defense	27,400	24,261	22,580
Department of Commerce	20,306	24,727	24,211
Department of Energy	4,192	4,527	3,800
Dept. of Health & Human Services	5,531	7,419	5,282
Dept. of Homeland Security	14,141	18,760	15,114
Department of Justice	4,853	8,971	5,200
Department of Transportation	514	745	350
Department of the Treasury	143	57	0
Department of Veterans Affairs	155	210	200
Environmental Protection Agency	86	147	100
General Services Administration	205	617	531
National Aeronautics & Space Admin.	2,459	2,513	2,723
National Science Foundation	2,805	2,775	2,500
Nuclear Regulatory Commission	2,514	2,500	2,400
Other	6,148	5,577	3,279
Subtotal, Other Agency	91,452	103,806	88,270
Calibrations & Testing	7,720	8,244	7,575
Technical & Advisory Services	20,081	25,660	24,339
Standard Reference Materials	17,108	21,986	22,034
Subtotal, Other Reimbursables	44,909	55,890	53,948
Total, Reimbursable Program	136,361	159,696	142,218
Equipment Transfers	0	500	500
Subtotal, WCF transfer	0	500	500
Equipment Investments	22,232	22,117	21,654
IE Amortization	(18,318)	(17,524)	(21,654)
WCF Operating Adjustments	3,454	0	0
Total, WCF Investments	7,368	4,593	0
Total, Reimbursable Program and WCF Investments	143,729	164,789	142,718

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

Program: Measurement science, services, and programs
Sub-program: Corporate services

		2015 Actual		2016 Enacted		2017 Base		2017 Estimate		Increase/ (Decrease) over 2017 Base	
Line Item		Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount
Corporate services	Pos./Approp	43	$17,311	43	$17,311	43	$21,262	43	$21,285	0	$23
	FTE/Obl.	42	17,328	43	17,475	43	21,365	43	21,388	0	23
Total	Pos./Approp	43	17,311	43	17,311	43	21,262	43	21,285	0	23
	FTE/Obl.	42	17,328	43	17,475	43	21,365	43	21,388	0	23

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

	FY 2015 Actual	FY 2016 Enacted	FY 2017 Estimate
Department of Defense			
Department of Commerce	$3,409	$3,699	$3,755
General Services Administration	6	10	10
Subtotal, Other Agency	3,415	3,709	3,765
Total, Reimbursable Program	3,415	3,709	3,765
Equipment Investments	2,267	2,236	2,350
IE Amortization	(2,184)	(1,887)	(2,350)
Total, WCF Investments	83	349	0
Total, Reimbursable Program and WCF Investments	3,498	4,058	3,765

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

Program: Measurement science, services, and programs
Sub-program: Standards coordination and special programs

Line Item		2015 Actual Personnel	2015 Actual Amount	2016 Enacted Personnel	2016 Enacted Amount	2017 Base Personnel	2017 Base Amount	2017 Estimate Personnel	2017 Estimate Amount	Increase/ (Decrease) over 2017 Base Personnel	Increase/ (Decrease) over 2017 Base Amount
Standards coordination and special programs	Pos./Approp	190	$66,884	190	$67,533	190	$68,466	190	$70,566	0	$2,100
	FTE/Obl.	188	77,967	196	80,240	196	68,503	196	73,602	0	5,099
Total	Pos./Approp	190	66,884	190	67,533	190	68,466	190	70,566	0	2,100
	FTE/Obl.	188	77,967	196	80,469	196	68,503	196	73,602	0	5,099

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

	FY 2015 Actual	FY 2016 Enacted	FY 2017 Estimate
Department of Defense			
Other, Department of Defense	0	$200	0
Subtotal, Department of Defense	0	200	0
Department of Commerce	$174	0	0
Dept. of Health & Human Services	75	75	$75
Dept. of Homeland Security	161	200	200
Department of Justice	241	670	100
Subtotal, Other Agency	651	1,145	375
Technical & Advisory Services	6,625	4,278	3,835
Subtotal, Other Reimbursables	6,625	4,278	3,835
Total, Reimbursable Program	7,276	5,423	4,210
Equipment Investments	1,113	7	0
IE Amortization	(200)	(261)	0
Total, WCF Investments	913	(254)	0
Total, Reimbursable Program and WCF Investments	8,189	5,169	4,210

APPROPRIATION ACCOUNT: Scientific and Technical Research and Services (STRS)

BUDGET PROGRAM: Laboratory Programs

The request for Laboratory Programs is roughly $730.5 million, an increase of $40.5 million above the FY 2016 enacted level. The $40.5 million increase funds inflationary price changes as well as seven initiatives described in greater detail in the Program Changes section.

BASE JUSTIFICATION

Laboratory Programs Overview

The NIST Laboratory Programs work at the frontiers of measurement science to ensure the U.S. system of measurements is firmly grounded on sound scientific and technical principles. The NIST laboratories address increasingly complex measurement challenges, ranging from the very small (nanoscale devices) to the very large (vehicles and buildings), and from the physical (renewable energy sources) to the virtual (cybersecurity and cloud computing). As new technologies develop and evolve, NIST's measurement research and services remain central to innovation, productivity, trade, and public safety.

The NIST Laboratory Programs provide industry, academia, and other federal agencies with:

- scientific underpinnings for basic and derived measurement units, international standards, measurement and calibration services, and certified reference materials;
- impartial expertise and leadership in basic and applied research that enables development of test methods and verified data to support efficient commercialization and commerce;
- expertise and support for consensus-based standards development, with associated test methods for conformity; and,
- unique, cutting-edge user facilities that support innovation in emerging technology areas.

NIST creates the infrastructure necessary to measure the performance and quality of products and services. In close cooperation with industry, academia, and other federal agencies, NIST continually advances measurement science, develops standard protocols and test methods, and evaluates and generates data. These tools, which the private sector cannot provide due to the high cost and unique skills needed, are the foundations for interoperability between products and systems, enabling global trade.

Industry relies on NIST for the physical measurements and standards needed to enable advanced manufacturing, to develop and test new materials, to enable innovation, and to ensure compliance with regulations. In addition, NIST provides measurement and calibration products and services via its Standard Reference Materials (SRM), calibration services, and Standard Reference Data (SRD) programs. These products and services assure the accuracy of measurements made daily throughout the U.S.

Technology is rapidly evolving to integrate new capabilities across the economy, including manufacturing processes, transportation systems, critical infrastructure, and healthcare. While these innovations will contribute to the U.S. economy and quality of life, they have associated challenges in interoperability, security, and resiliency. The NIST Laboratory Programs respond to these challenges by engaging with government and industry stakeholders to develop the standards, prototypes, and guidelines essential for technology adoption and dissemination. In addition, NIST provides test-beds, testing and validation methodologies, and support for certification to support technology deployment.

Accomplishments

Recent highlights of accomplishments from the Laboratory Programs include:

- Community Resilience: NIST issued the Community Resilience Planning Guide for Buildings and Infrastructure Systems as a draft for public comment in April 2015. The Guide provides a practical and flexible approach to help communities protect themselves against the high tolls caused by natural, technological, and human caused hazards through better setting of priorities, allocation of resources, and reduction of hazard risks to lives, livelihoods, and quality of life. The Guide will lead communities to better integrate resilience plans into their economic development, zoning, mitigation, and other local planning activities that impact buildings, public utilities, and other infrastructure systems. It engages a broad range of community stakeholders and representatives in a series of six steps that include defining how vital social functions, such as healthcare, education, and public safety are supported by buildings and infrastructure systems (transportation, energy, communications, and water and wastewater).
- Precision Medicine: NIST issued the world's first reference material to help ensure laboratories accurately "map" DNA for genetic testing, medical diagnoses and, future customized drug therapies. The new reference material, NIST RM 8398, is a "measuring stick" for the human genome, the coded blueprints of a person's genetic traits. It provides a well-characterized standard that can tell a laboratory how well its processes for determining the patterns in a person's DNA (called DNA or gene sequencing) are working by measuring the performance of the equipment, chemistry, and data analysis involved. NIST RM 8398 was created by NIST and its partners in the Genome in a Bottle consortium, a group that includes stakeholders from industry, academia and the federal government.
- Nanotechnology: NIST's Center for Nanoscale Science and Technology (CNST) developed and used world-leading scanned probe instrumentation to make unprecedented atomic scale measurements in graphene. Electronic devices based on graphene, and other two-dimensional materials, are being pursued by the U.S. electronics industry as replacements for silicon in its pursuit of faster, smaller, and more energy-efficient electronic devices. These measurements enable deeper understanding of these new materials, leading to new designs for high speed digital switches.
- Quantum Based Measurements: NIST and JILA[1] researchers recently improved the stability level of the strontium lattice clock at JILA to an unprecedented level. The new atomic clock has achieved a level of stability that enables it to neither gain nor lose one second in more than a billion years. NIST's precision timekeeping service is used more than 12 billion times per day and has broad impacts on advanced communications, positioning technologies (such as GPS), and many other technologies that impact the daily lives of everyone on the planet.
- Smart Cities: NIST sponsored the Global City Teams Challenge that brought together more than 20 cities and communities with over 180 universities and companies in 45 teams to deploy smart city solutions that apply advanced cyber-physical systems concepts. The projects demonstrate how to integrate city-scale IT and physical infrastructures for powerful new safe, reliable, secure, privacy-enhancing, and cost-saving platforms and services that make communities more livable, workable, safe, and sustainable and that support an informed and engaged populace.
- Advanced Communications: Most mobile devices operate below 3 gigahertz (GHz), but some devices are starting to use fast silicon-germanium radio chips operating at millimeter (mm) wavelengths above 10 GHz and researchers are pursuing channels up to 100 GHz. The metrology infrastructure for telecommunications at these frequencies is incomplete. NIST

[1] The name of the organization was officially changed to "JILA" in 1995; it is no longer an acronym.

developed a calibrated, modulated signal source to test mm wave instruments to support wireless communications at higher frequencies offering more channel capacity. The new facility has been demonstrated at 94 GHz, traceable to fundamental physical quantities.

This small subset of recent accomplishments is representative of the diverse nature of scientific needs satisfied by the Laboratory Programs. Many more interesting accomplishments can be found at: http://www.nist.gov/public_affairs/tech-beat/

NIST Laboratory Program Priorities

NIST continually collects information on major national issues, shifting trends in science and technology, and the performance of operational processes through a variety of mechanisms including meetings, workshops, industry visits, and objective peer review of its programs. This input is viewed in the context of the NIST mission to make decisions on where NIST needs to develop specific capabilities, how to best marshal existing resources to address current issues, and how to continually optimize the organization for improved performance. Based on these efforts the following are seen as key priorities for NIST Laboratory Program R&D efforts.

Advanced Manufacturing and Precision Metrology – The U.S. must remain a competitive force in advanced manufacturing in order to ensure our economic and national security. The NIST Laboratories have prioritized research efforts that support advanced manufacturing by advancing the state-of-the-art across multiple key technology areas.

- Additive Manufacturing: NIST will develop true temperature measurement methods to enable improvements and verification of high-fidelity additive manufacturing (AM) process models, as well as quality control and assurance, for rapid qualification of AM materials and processes for high-performance commercial applications.
- Advanced Sensing: NIST will expand efforts to develop measurement science and standards that will accelerate the design, development, and manufacturability of advanced electronic and photonic devices - those that require new concepts, architectures, materials, and manufacturing methods. NIST will address a rapidly emerging trend in manufacturing: the need for non-invasive sensing and real-time process analysis to reduce the rejection rate associated with manufacturing products that involve multiple complex steps. NIST will provide measurement science and standards to support the development of distributed and ubiquitous devices that can be integrated everywhere by consumers and manufacturers to meet diverse needs.
- Advanced Materials and the Materials Genome Initiative: NIST has a key role in the Materials Genome Initiative (MGI), an interagency effort to capitalize on recent breakthroughs in materials modeling, theory, and data mining to significantly accelerate discovery and deployment of advanced materials while decreasing their cost. To support this effort, NIST is developing an advanced materials innovation infrastructure, including data assessment and validation, data standards, and modeling and simulation tools. New measurement science and standards developed based on this infrastructure will enable industrial researchers to discover data and models, assess their quality, and use them to maximum effect.
- Nanotechnology and Nanomanufacturing: NIST will support the rapid development of scalable nanomaterial production processes with applications in high-performance materials, healthcare, and energy. NIST will advance the development of high-throughput metrology techniques to enable rapid, precise, and accurate measurements of nanoparticle size and shape in manufacturing, particularly using integrated opto-nanofluidic devices to enable process control of engineered nanomaterials. Through the CNST, NIST will educate a new generation of nanotechnologists by providing young scientists and engineers with the ability to use some of the world's most advanced instrumentation.

- Quantum Based Sensors/Measurements: Quantum information science is an emerging research field with the potential to revolutionize computation, communication, precision measurement, and fundamental quantum science. This field seeks to harness the fundamental laws of physics to dramatically improve information acquisition, transmission, and processing. NIST will expand efforts to advance quantum information science to improve information security and assurance, improve standards, and develop more-sensitive sensors for a variety of applications.

Biosciences – Research in bioscience is driving several critical economic sectors and a vast array of critical measurement needs have emerged to support this research. NIST is committed to meeting the metrology needs to support this industry by prioritizing research efforts on the following topics:

- Biomanufacturing: The vision of industrial biomanufacturing is to use living organisms to produce a commodity, such as fuel, chemicals, pharmaceuticals, or medical therapies. Creating efficient, reliable biomanufacturing processes requires the development of tools to explore, manipulate, and ultimately explain the intricate complexities of biological cells. NIST will address the technical challenges faced by the biomanufacturing industry by developing a suite of quantitative methods for accurate measurement of biological systems, creating the necessary tools to methodically design and test engineered organisms. Such tools are badly needed but challenging to develop since biological cells are inherently complex and interact with the environment in unexpected ways. NIST will use its convening power and its expertise in precision measurement to coordinate the strategic development and implementation of accurate and quantitative measurements of engineered biological systems.
- Healthcare and Precision Medicine: NIST will develop and disseminate a vast array of reference methods and protocols, reference materials, measurement quality assurance programs, and new instrumentation needed to advance biomedical technologies. These tools will support a variety of healthcare innovations including whole genome sequencing, early detection and diagnosis of diseases such as cancer, and genetics-based diagnostics for detection of chromosomal disorders; blood protein health status marker detection, such as those used for detection of heart attack, kidney function, and prostate cancer; the development manufacturing and regulatory approval of innovative biopharmaceuticals such as protein therapeutics; and ensuring the reliability of implanted medical devices such as pacemakers.

Built Environment – The U.S. relies on our built environment as critical infrastructure needed to support our economic and social stability and competitiveness. The performance of our built environment can have a profound impact on our daily lives and our ability to thrive, and disruptions to it can have severe consequences. NIST has prioritized research programs in the following areas to improve our built environment:

- Energy Efficiency: Buildings consume 72 percent of all electricity in the U.S. and space conditioning is the largest single use in buildings. Heating, Ventilating, and Air-Conditioning (HVAC) equipment rarely operates as designed throughout their useable lifetime. Commercial products intended to diagnose HVAC system faults have had little market acceptance because of a lack of customer and industry confidence. NIST will develop software tools and a rating methodology for evaluating the performance of such products, which is an essential step towards achieving "as designed" performance. This will significantly increase the operating efficiency of HVAC equipment used in homes and small businesses.
- Indoor Environment: Manufacturers and designers need to be able to more accurately estimate indoor contaminant levels associated with different product choices, and support existing and future product labeling programs. NIST will assess the suitability, stability, usability,

homogeneity, and emission rate of a prototype formaldehyde emission reference standard for use in product emission testing.

- Resilience: Preventing hazards (e.g., earthquakes, hurricanes, and community-scale fires) from becoming debilitating disasters depends on the resilience of our buildings and infrastructure. To enhance disaster resilience stakeholders must be able to predict the effects of hazards on the performance of complex structural systems. Developing tools to make such predictions will require data to characterize the hazard, validated physics-based models to predict performance, metrics for measuring performance, and mitigation strategies based on performance evaluation. NIST will develop the measurement science required to achieve disaster resilient buildings and infrastructure in a timely manner.

Digital Economy – The digital economy is an extraordinary platform for innovation, growth, and social progress. As it grows in size, scope, and importance, NIST is committed to helping the U.S. achieve and maintain global leadership on internet and technology issues. NIST has prioritized programs in the following areas to achieve this goal:

- Advanced Communications: New and improved spectrum sharing technologies will address spectrum scarcity due to strict, exclusive, and static allocation of frequency bands. Spectrum sharing technologies could benefit many applications, such as device-to-device communications in mobile cellular networks and sensor networks and prioritizing traffic in the unlicensed spectrum. However, spectrum sharing involves multiple users with diverse technologies interacting with the system, which could produce unwanted interference or performance degradation for primary users. To promote industry adoption of spectrum sharing technologies, NIST will build a multi- purpose test facility that can replicate a variety of complex electromagnetic environments to accurately determine the interference, coexistence, and electromagnetic compatibility of these wireless devices and systems. NIST will also develop spectrum sensing and spectrum coordination technologies, thus allowing industry to identify potential issues with next generation wireless systems before they are commercialized and deployed.
- Advanced Networking: NIST will develop advanced test and measurement techniques to characterize and improve designs for fundamentally new architectures and protocols for core internet services including new routing, information centric networking architectures, and software defined and virtualized networks.
- Big Data and Data Science: NIST will develop standards, guidelines, and best practices to enable reliability, security, and privacy-protection that facilitate innovative big data approaches for storage and access, analytics, knowledge extraction, fusion/integration, usability, and visualization that are generalizable across multiple sectors.
- Cyber-Physical Systems: Today's smart city systems are often custom implementations that are costly and inefficient; create stranded systems that cannot readily be upgraded or extended. NIST will develop measurement science and technical standards required for the design and performance measurement of scalable, extensible, and interoperable smart city solutions that empower U.S. communities and ensure American companies can be competitive in the rapidly growing global smart city market.
- Cybersecurity and Privacy: The proliferation of data generation, storage, and use associated with the digital economy is making it increasingly important to protect that data with effective cryptography and privacy standards. Furthermore, with more citizens using web-based tools for everyday activities, there is a pressing need for these tools to provide privacy assurance. Individual, corporate, and public sector data privacy is continuously at risk from attacks by individual actors, criminal organizations, and nation-states. NIST will address the rapidly emerging threats in this field by furthering the development of new and needed cryptographic standards and technologies.

- Scientific Data: NIST will continue to generate and maintain data of the highest quality, characterization, and integrity. NIST's SRD collection is a national asset for research and industry, containing physical, material, chemical, and biological data covering a broad range of substances and properties. NIST will continue to find ways to make this SRD more usable and accessible, and to expand the suite of SRDs to meet stakeholders' needs.

Additional Information on NIST Laboratories

NIST's Laboratory Programs consists of seven major Laboratories in Gaithersburg, Maryland and Boulder, Colorado. Additional information on recent activities specific to each of these Laboratories can be found online through the web sites provided below:

- Center for Nanoscale Science and Technology:
  http://www.nist.gov/cnst/index.cfm

- Communications Technology Laboratory:
  http://www.nist.gov/ctl/index.cfm

- Engineering Laboratory:
  http://www.nist.gov/el/index.cfm

- Information Technology Laboratory
  http://www.nist.gov/itl/index.cfm

- Material Measurement Laboratory
  http://www.nist.gov/mml/index.cfm

- NIST Center for Neutron Research
  http://www.nist.gov/ncnr/index.cfm

- Physical Measurement Laboratory
  http://www.nist.gov/pml/index.cfm

PROGRAM CHANGES:

1. Measurement Science for Future Computing Technologies and Applications (Base Funding: $12.0 million and 18 FTE; Program Change: +$13.6 million and +19 FTE)

NIST requests an increase of $13.6 million and 19 FTE to position the U.S. to unlock the potential of future computing technologies, which will revolutionize and transform U.S. economic competitiveness. These efforts are critical to the National Strategic Computing Initiative (NSCI), which is a government-wide effort designed to create a cohesive, multi-agency strategic vision and federal investment strategy, executed in collaboration with industry and academia, to maximize the benefits of high performance computing for the U.S.

A strong and sustained investment in forward-looking basic research is required to maintain the technical infrastructure of an innovative, high-technology economy as called for in the DOC Strategic Objective 2.1. By enabling the next generation of computing technologies, this initiative will support the future of modeling and simulation, data analytics, and the internet-of-things, all of which will strengthen the nation's digital economy, the DOC Strategic Objective 2.2.

NIST's ability to push the envelope of measurement science has regularly delivered new pathways to innovation and novel solutions to the nation's innovation and technical challenges. One such challenge is to ensure that the U.S. maintains its leadership in scientific computing even as we meet the atomic limits of semiconductor miniaturization and conventional development approaches fail. Creating and deploying computing technology at the leading edge is vital to advancing government-wide priorities, spurring innovation, and ensuring U.S. leadership in research, development, and deployment. High-performance computing technologies including "exascale" machine hundreds of times faster than current fastest U.S. computers requires research and development to construct a foundation atop which future inventors and innovators can build. This means understanding and tackling the hardest measurement challenges in "over-the-horizon" future high-performance computing technology including hardware, software, data analytics and discovery tools, and other forward looking technologies.

Proposed Action 1: Develop and deploy measurement science for future computing technologies (+$8.8 million)

This initiative will support the development of measurement science, standards, tools and technologies to advance new computing paradigms. This includes research into fundamental measurement science to support those technologies, such as imaging techniques that can see single atoms and measurements so fast that they can watch a single computer switch as it switches. The new measurement tools that NIST develops through this initiative will benefit other computation-related applications, such as communications, big data, advanced materials and remote sensing.

NIST research will be targeted to:

- **Develop atomic scale metrology** that allows precision placement of individual atoms in a manner that can be scaled up to mass fabrication. The development of this technology is essential to making computer switches work at atomic sizes but in the near term will also benefit switches made from nanoscale semiconductors such as nanowires. Atomic scale metrology will be sensitive to single atom defects which is important as a single additional atom or missing atom could cause a device to fail. We will also develop measurements for

characterizing the operation of these devices to better understand how imperfections in atomic placement affect device performance.

- **Develop, test, prototype, and benchmark** potential types of logic, memory, and storage device concepts that are likely to become more highly integrated in order to address the memory and storage requirements in an "exascale" machine. To meet these needs, NIST will: (1) develop capabilities to prepare thin film material stacks for use in advanced computing devices, and (2) develop devices that can be measured during switching with high-resolution electron microscopy magnetic measurements and optical spectroscopies.

Proposed Action 2: Develop and deploy measurement science for next generation computing applications (+$4.8 million)

New computing hardware components and systems will have impact on computing at all scales, from the desktop to leadership class computing facilities. However, hardware is but one facet of the infrastructure needed to effectively exploit next generation computing capabilities. Specialized algorithms and software must also be created, made usable, and promulgated. These will help increase the capacity and capability of an enduring national high-performance computing ecosystem through the development and deployment of measurement foundations which will enable computational simulation supported by mathematical modeling, known as virtual prototyping. Such virtual prototyping can be used to optimize product design, reduce cost, and decrease time to market. While there have been some successful industrial applications of virtual prototyping, they require expensive expertise and currently use ad-hoc methodology.

One fundamental missing ingredient for adoption of virtual prototyping is a formal measurement infrastructure for assessing the quality of results produced by computational simulation. Without this infrastructure to support computationally informed decision-making, high-consequence decisions based on simulation are risky. Creation of such a vigorous measurement infrastructure represents a new and critical pathway for NIST to fulfill its mission as the U.S. metrology institute.

NIST research will be targeted to:

- ***Develop standard frameworks for uncertainty quantification in scientific computing.*** Uncertainty analysis for physical measurement rests on an internationally recognized set of principles as described in the *Guide to the Expression of Uncertainty in Measurement*[2]. However, characteristics of complex simulation such as high-dimensional, correlated parameter spaces, and non-linear and computationally expensive measurement functions reveal that this current uncertainty framework is inadequate for scientific computing contexts[3]. NIST will join with other metrology institutes to extend this international framework as required by this new measurement paradigm.

- ***Establish a calibration framework for modeling and simulation.*** NIST currently disseminates standard reference materials (SRMs) supporting diverse, critical measurement needs. These reference materials are used to calibrate measurement devices and promote measurement traceability back to the fundamental system of units maintained by international metrology institutes. Such traceability chains establish scientific foundations for measurement,

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[2] JCGM Working Group 1, 2008. *Evaluation of Measurement Data--Guide to the Expression of Uncertainty in Measurement,* Sevres: Joint Committee for Guides in Metrology.

[3] Bar, M., 2011. *Novel Mathematical and Statistical Approaches to Uncertainty Evaluation,* Braunschweig, Germany: European Association of National Metrology Institutes.

resulting in measurement stability and cross-comparability, which in turn provide the ensuing benefits of level playing fields for free markets. NIST will undertake two analogous activities to extend traceability constructs and benefits into the modeling and simulation space:

- *Standard Reference Computations (SRCs)*: Building upon past successes in areas such as micromagnetic modeling, NIST will team with external stakeholders to define and solve critical computational benchmark problems. Such SRCs will extend the reach of traceability into modeling and simulation and virtual prototyping.

- *Calibration Roadmap for Modeling and Simulation.* NIST will work with industry, government and academia to establish a Roadmap to achieve a calibration infrastructure for modeling and simulation. The Roadmap will identify requirements, technology and research gaps, and standards needs.

Statement of Need and Economic Benefits

Over the past six decades, U.S. computing capabilities have been maintained through continuous research and the development and deployment of new computing systems with rapidly increasing performance on applications of major significance to government, industry, and academia. Maximizing the benefits of high performance computing in the coming decades will require an effective national response to increasing demands for computing power, emerging technological challenges and opportunities, and growing economic dependency on and competition with other nations. This national response will require a cohesive, strategic effort within the federal government and a close collaboration between the public and private sectors. As described in Executive Order 13702, "Creating a National Strategic Computing Initiative," issued July 29, 2015, NIST has a critical role to play in the national response, focusing on measurement science to support future computing technologies.

Improvements in both basic and applied aspects of new computing technologies have far-reaching industrial applications, national security implications, and economic benefits. For example, high performance computing can lead to better weather modeling, airplane design, understanding of complex systems, drug design, scientific discovery, and big data analytics. Referring to modeling, simulation and analysis, and high performance computing, a recent report[4] submitted to the Department of Commerce by the Council on Competitiveness states:

> *"Widespread deployment across the U.S. industrial landscape would dramatically enhance the U.S. ability to innovate, accelerate the development and commercialization of new products, and improve manufacturing productivity, driving U.S. economic growth and global market competitiveness."*

Creating the measurement science to support future computing technologies will help to ensure that the U.S. maintains leadership in future high performance computing and assure strategic advantage for both economic and national security applications.

This initiative will enable NIST to support continued U.S. leadership in high-performance computing (HPC), in support of recent Executive Order 13702, "Creating a National Strategic Computing Initiative." Growth in both basic and applied aspects of new computing technologies has far-reaching

[4] Modeling, Simulation and Analysis, and High Performance Computing: Force Multiplier for American Innovation, Final Report to the US Department of Commerce Economic Development Administration, Council on Competitiveness, 2015.

industrial applications, national security implications, and economic benefits. Past national investment in HPC has contributed substantially to national economic prosperity and rapidly accelerated scientific discovery in areas such as neuroscience, industrial systems, astronomy, and energy technologies. Leadership in this area is frequently linked to national security and global competitiveness, with other nations making significant investments in this area (notably, China and the EU). U.S. leadership is not assured; in fact at this time China leads the world in HPC performance with its Tiahne-2 supercomputer[5]. There is not a clear pathway to achieving the new technologies needed for future HPC. Foundational research and development is essential to discover and establish a path forward for HPC, even after the limits of current semiconductor technology (essential for the hardware used in HPC) are reached, in the next decade. The growth of ubiquitous sensing technologies to support the internet of things will also require advanced computing technologies.

Base Resource Assessment

In FY 2015, NIST made the following investments in base STRS funding associated with this initiative for a total of $12.0 million:

- $10.5 million in advanced computer technologies.
- $1.5 million in metrology for modeling and simulation.

NIST has developed intrinsic nanoscale atomic placement metrology using references based upon atomic spacings for characterization of devices with nano-dimensions. NIST also has existing expertise in thin-film metrology, transport measurements, and rapid scan and characterization tools which are critical to fulfilling this ambitious initiative. During the course of the initiative we will continually reassess which paths look most promising in order to address the most pressing metrological and measurements challenges.

NIST is also a world leader in uncertainty quantification – in information technology and other realms – and has deep expertise to lend to this initiative. NIST has relevant expertise in the application of applied and computational mathematics to the solution to science and engineering problems arising in measurement science and related applications, including challenges related to high performance computing and best practices for characterization of uncertainty. NIST accomplishes this through a program of R&D in mathematical and computational techniques and tools, collaboration with experts, and the dissemination of reference data and software.

NIST is an essential part of the National Strategic Computing Initiative because of its continued success pushing measurement science forward to advance computing technologies. NIST's expertise is currently distributed across multiple laboratories, in areas from fundamental quantum and atomic physics to nanoscale material science and characterization, to computer architectures and modeling. In terms of semiconductor metrology, NIST has a well-established base that has historically supported manufacturers such Intel and Global Foundries to address today's measurement science challenges (for example, exploring the limits of advanced manufacturing techniques to make chips that push the limits of Moore's law, in line with near-term 2020 targets on the "International Technology Roadmap for Semiconductors"). To a much lesser extent NIST has research projects addressing future computer technologies that will enable the vision of the National Strategic Computing Initiative supported with non-base funding. For example, NIST has an exploratory project in atom-based devices for quantum computing. However, a multitude of unconventional approaches must be pursued at critical mass with long-term stability to adequately

[5] http://www.top500.org/list/2015/06/

prepare for future HPC needs. NIST requires additional funding to substantially increase core expertise towards these fundamentally new and unchartered applications of physics and materials science to revolutionize computing.

Schedule and Milestones

Action 1: Develop and deploy measurement science for future computing technologies

- Engage with stakeholders on measurement needs in support of "over-the-horizon" technologies for exascale computing and beyond. (FY 2017 - FY 2018)
- Develop 2 nm oxidation and etch process and integrate atomic dopant placement with patterning, oxide etch, and overgrowth. Explore alternative single dopant schemes. Integrate conventional structures with nm resolution H-patterning and two-dimensional doping to form electrical contacts and side-gated regions forming ultra-small devices with sub-5 nm features. (FY 2017 – FY 2019)
- Test and model single or few-atom ultimately scaled atomic devices with deterministically placed individual dopants. Measure the energetics and transport of single/two dopant devices and manipulate the system using gate voltages. (FY 2019 - FY 2021)
- Develop capabilities to prepare well-controlled thin film materials including the ability to fabricate material stacks and measure their structure with up to 15 elements without breaking vacuum and novel 2D electronic materials. (FY 2017 - FY 2020)
- Develop capabilities to measure the materials structure of advanced devices at atomistic levels during operation, including under varying electrical bias and magnetic fields, needed to identify performance limits. (FY 2017 – FY 2019)

Action 2: Develop and deploy measurement foundations for next generation computing applications

- Develop methodologies and tools for verification, validation and uncertainty quantification for scientific and engineering computation. (FY 2017 – FY 2020)
- Develop a formal framework for uncertainty quantification in computational experiments analogous to that for physical experiments. (FY 2019 – FY 2020)
- In collaboration with industrial partners, develop a series of standard reference computations in particular application areas of mutual interest which can be used as a benchmark to verify and calibrate other simulation techniques and tools. (FY 2019 – FY 2021)
- Host workshops to assess needs and develop concepts related to the calibration infrastructure needed to enable uncertainty assessments for modeling and simulation; engage both stakeholders from government (e.g., the regulatory community) and industry (e.g., product developers). (FY 2017 – FY 2018)
- Working with industry, government and academia, establish a roadmap to achieve a calibration infrastructure for modeling and simulation. (FY 2020 – FY 2021)

Deliverables

Action 1: Develop and deploy measurement science for future computing technologies

- Tools for characterizing waveforms at up to 200 GHz with the possibility to go to 400 GHz.
- Tools and calibration systems required to synthesize single and multi-tone waveforms useful for 4G metrology with spur-free dynamic range greater than 40 dB and readily extendable to 5G technology.
- Tools and measurement capabilities to build and characterize single atom devices that are gated and interconnected and can demonstrate simple logic operations at GHz clock speed.
- Tools and measurement science required for imaging and rapidly characterizing reduced dimensional logic structures at GHz rates including buried structures.
- Tools for measuring the materials structure of advanced devices at atomistic levels during operation, including under varying electrical bias and magnetic fields in order to determine performance limits.

Action 2: Develop and deploy measurement foundations for next generation computing applications

- Reports describing new technologies, tools, and proposed guidelines for uncertainty quantification in modeling and simulation to enable widespread exploitation of future computing technologies and applications.
- Published framework for uncertainty quantification in computational experiments analogous to that for physical experiments.
- Published roadmap to achieve a calibration infrastructure for modeling and simulation.
- Published guidance on a formal metrology infrastructure to improve the confidence in decisions made using results of large-scale science and engineering computation.

Performance Goal: Develop measurement science for future computing	FY 2017 Target	FY 2018 Target	FY 2019 Target	FY 2020 Target	FY 2021 Target
With increase	20	23	27	30	33
Without increase	10	11	12	13	14
Description:	Number of new scientific and technical publications and conference proceedings related to these advanced computing technologies.				

Performance Goal: Develop measurement science for future computing	FY 2017 Target	FY 2018 Target	FY 2019 Target	FY 2020 Target	FY 2021 Target
With increase	1	3	4	5	7
Without increase	1	2	2	2	2
Description:	Number of new measurement services, standard reference materials, documentary standards, tutorials, patents, standard reference data, and test structures related to these advanced computing technologies.				

Performance Goal: Develop measurements for next generation computing applications	FY 2017 Target	FY 2018 Target	FY 2019 Target	FY 2020 Target	FY 2021 Target
With increase	2	3	5	7	9
Without increase	0	1	1	1	1
Description:	Number of new scientific and technical publications, new measurement services, standard reference materials, documentary standards, tutorials, patents, and standard reference data related to these advanced computing technologies.				

PROGRAM CHANGE PERSONNEL DETAIL

Program: Measurement Science, Services, and Programs
Subprogram: Laboratory Programs
Program Change: Measurement Science for Future Computing Technologies and Applications

Title:	Location	Grade	Number of Positions	Annual Salary	Total Salaries
Material scientist	Gaithersburg	ZP V	1	$127,886	$127,886
Physicist	Gaithersburg	ZP V	1	127,886	127,886
Physical scientist	Gaithersburg	ZP V	1	127,886	127,886
Mathematician	Gaithersburg	ZP V	1	127,886	127,886
Statistician	Gaithersburg	ZP V	1	127,886	127,886
Computer scientist	Gaithersburg	ZP V	1	127,886	127,886
Material scientist	Gaithersburg	ZP IV	1	108,720	108,720
Physicist	Gaithersburg	ZP IV	2	108,720	217,440
Chemist	Gaithersburg	ZP IV	1	108,720	108,720
Electrical engineer	Gaithersburg	ZP IV	2	108,720	217,440
Physical scientist	Gaithersburg	ZP IV	1	108,720	108,720
Mathematician	Gaithersburg	ZP IV	1	108,720	108,720
Statistician	Gaithersburg	ZP IV	1	108,720	108,720
Computer scientist	Gaithersburg	ZP IV	2	108,720	217,440
Physicist	Gaithersburg	ZP III	1	77,371	77,371
Electrical engineer	Gaithersburg	ZP III	1	77,371	77,371
Mathematician	Gaithersburg	ZP III	1	77,371	77,371
Statistician	Gaithersburg	ZP III	1	77,371	77,371
Administrative support	Gaithersburg	ZA III	2	77,371	154,742
Administrative support	Gaithersburg	ZA II	2	53,353	106,706
Total			25		2,534,168
Less Lapse		25%	(6)		(633,542)
Total full-time permanent (FTE)			19		1,900,626
2017 Pay Adjustment (1.6%)					30,410
TOTAL					1,931,036

Personnel Data	Number
Full-Time Equivalent Employment	
Full-time permanent	19
Other than full-time permanent	0
Total	19
Authorized Positions:	
Full-time permanent	25
Other than full-time permanent	0
Total	25

PROGRAM CHANGE BY OBJECT CLASS
(Dollar amounts in thousands)

Program: Measurement Science, Services, and Programs
Subprogram: Laboratory Programs
Program Change: Measurement Science for Future Computing Technologies and Applications

	Object Class	2017 Increase	FY 2017 Total Program
11	Personnel compensation		
11.1	Full-time permanent	$1,931	$227,881
11.3	Other than full-time permanent	0	23,339
11.5	Other personnel compensation	0	1,865
11.8	Special personnel services payments	0	0
11.9	Total personnel compensation	1,931	253,085
12	Civilian personnel benefits	631	82,562
13	Benefits for former personnel	0	0
21	Travel and transportation of persons	162	10,547
22	Transportation of things	18	1,202
23.1	Rental payments to GSA	0	118
23.2	Rental Payments to others	0	1,655
23.3	Communications, utilities and miscellaneous charges	1,669	29,115
24	Printing and reproduction	14	454
25.1	Advisory and assistance services	0	4,407
25.2	Other services	817	30,495
25.3	Purchases of goods & services from Gov't accounts	942	31,426
25.4	Operation and maintenance of facilities	0	0
25.5	Research and development contracts	1,375	5,327
25.6	Medical care	0	0
25.7	Operation and maintenance of equipment	146	13,257
25.8	Subsistence and support of persons	0	0
26	Supplies and materials	502	35,668
31	Equipment	1,068	57,321
32	Lands and structures	0	0
33	Investments and loans	0	0
41	Grants, subsidies and contributions	3,800	84,203
42	Insurance claims and indemnities	0	0
43	Interest and dividends	0	0
44	Refunds	0	0
99	Direct obligations	13,075	640,842
	NIST Transfer to Working Capital Fund	500	
	Total obligations	13,575	

2. Advanced Sensing for Manufacturing (Base Funding: $5.0 million and 16 FTE; Program Change: +$2.0 million and +5 FTE)

NIST requests an increase of $2.0 million and 5 FTE to support U.S. competitiveness in advanced manufacturing by filling sensing and measurement gaps in the areas of advanced sensors used for process control.

Proposed Action: Advanced Sensing for Manufacturing

The long-term competitiveness of the U.S. economy relies heavily on the ability of the manufacturing sector to establish and maintain itself as a global leader. Advanced manufacturing technologies will revitalize this sector and ensure that it continues to be the engine of innovation and job creation that the U.S. needs for a secure and sustainable future. The challenge of revitalizing our economy through advanced manufacturing is clearly expressed in the original President's Council of Advisors on Science and Technology Advanced Manufacturing Partnership (AMP) report published in 2012, Report to the President on Capturing Domestic Competitive Advantage in Advanced Manufacturing[6]. Since then, the U.S. government has made major advances in implementing the recommendations from the original report. In 2014, the follow-up committee issued the Report to the President Accelerating U.S. Advanced Manufacturing (AMP 2.0), which made further recommendations. In the report, the AMP 2.0 Recommendation #4 specifically states the need for "standards enabling exchange of manufacturing process information". This new NIST initiative directly addresses the challenges raised in the AMP 2.0 (Annex 1 and 2) and will help position U.S. manufacturers as leaders in advanced materials and manufacturing technologies.

A nationwide infrastructure that includes the scientific measurement tools and standards that industry needs to develop and advance their manufacturing methods is imperative. Ensuring that U.S. industry has the scientific and technical tools needed to stay competitive is the goal of the NIST laboratory research programs – as industry innovates, develops new technologies, and evolves, so must the work done at NIST. The investment requested here will support NIST so that it can continue to meet needs identified by industry in the area of advanced technology products and processes, thus adding to a strong portfolio of manufacturing investment that is already in place but covers other critical areas in advanced manufacturing.

A highly integrated effort across NIST laboratories in measurement science and standards will accelerate the design, development, and manufacturability of advanced electronic and photonic devices - those that require new concepts, architectures, materials, and manufacturing methods. The future of the U.S. manufacturing industry hinges on a few key decisions that need addressed now, and the pending paradigm shifts require that NIST programs adapt to address the challenges facing this community. NIST will address a rapidly emerging trend in the industry today: the need for advanced sensing using non-invasive sensing and real-time process analysis to reduce the rejection rate during the manufacture of high-value added products that involves multiple complex steps. Our industries need breakthrough technologies, novel device architectures, and next-generation logic to realize necessary future sensor performance. Electronic components in 20 years will look vastly different than those of today, with new device concepts and means of computing and sensing (spin, quantum, optical) that incorporate a diversity of new materials (e.g., nanowires, 2D-layers), but, we do not yet know the path forward. NIST will provide measurement science and standards to support the development of distributed and ubiquitous devices that can be integrated everywhere by consumers and manufacturers, to meet diverse needs.

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[6]www.whitehouse.gov/sites/default/files/microsites/ostp/pcast_amp_steering_committee_report_final_july_17_2012.pdf

Statement of Need and Economic Benefits

Manufacturing continues to play an essential role in the U.S. economy and is tied intimately to our nation's capacity to innovate. The importance of advanced manufacturing, in general, and the components described in this initiative, specifically, have been recognized by leading industry and federal advisory groups, including, the President's Council of Advisors on Science and Technology, the NIST Visiting Committee of Advisors on Technology, the Institute for Defense Analyses and the National Academies. This importance was clearly stated in the original AMP report in 2012, and again in 2014 with the AMP 2.0 report. A 2012 study by the Institute for Defense Analyses[7] also identified a number of emerging manufacturing trends including new manufacturing methods and manufacturing with less labor-intensive and more information-technology intensive processes. In July, 2015 the Department of Defense created a Manufacturing Innovation Institute focused on integrated photonics manufacturing as part of the National Network for Manufacturing Innovation. The American Institute for Manufacturing Integrated Photonics is headquartered in Rochester, NY and consists of a consortium of companies, non-profits, and universities with a total public-private investment of over $610.0 million. The institute will focus on cutting-edge research in integrated photonics for a number of applications from telecommunications to medical technologies. Working closely with institute partners and other federal agencies, NIST researchers will accelerate the institute's efforts by providing fundamental measurement science for better diagnostics and process control during manufacture.

The future of U.S. advanced manufacturing will involve new paradigms, which will require fundamental measurement infrastructure and standards to invent new electronic components, reliably evaluate new materials and electronic performances, and benchmark various technologies. The semiconductor manufacturing industry is already a $300.0 billion industry supporting a $2.0 trillion electronic products industry and growth in both areas is expected. Advances in electronics components and sensors are critical for future process technologies and device components, for applications including photolithography for device fabrication, and precision lasers for materials processing. Reliable, low-cost discrete electronic and photonic parts manufacturing will require non-invasive real-time process monitoring sensors with quantified measurement uncertainties.

Base Resources Assessment

This initiative builds upon many programs across NIST in measurement science and standards development, but targets those manufacturing areas that are in critical need of investment to maintain pace in the international marketplace. The NIST laboratories have a long tradition of developing and delivering measurement science tools that support advanced manufacturing technologies. Existing capabilities that will be leveraged to achieve the goals of this initiative include NIST's expertise in materials modeling and simulation, in support of the Materials Genome Initiative, as well as expertise in nanomanufacturing, digital design, chip-scale measurement technologies, robotics, additive manufacturing, and cyber physical systems. A recent assessment of the NIST manufacturing-related programs conducted by the National Research Council found that NIST programs are "highly qualified and comparable to the best in the world."[8] Measurement science and standards services developed at NIST provide the basic and applied research underpinnings to support advances in manufacturing.

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[7] S. S. Shipp *et al.*, "Emerging Global Trends in Advanced Manufacturing," Institute for Defense Analysis, Mar. 2012.

[8] National Research Council. *A Review of the Manufacturing-Related Programs at the National Institute of Standards and Technology: Fiscal Year 2012.* Washington, DC: The National Academies Press, 2012.

NIST laboratories have a long history of providing measurement science and standards to support the semiconductor manufacturing industry. Current research focus includes "Beyond CMOS,"[9] defect characterization, reliability studies, and dimensional metrology. The research proposed in this initiative is based on knowledge gained through leadership roles in international road-mapping efforts and standards developing organizations.

NIST has built a scientifically strong base of excellence in electronic and photonic measurements and this initiative will enable NIST to focus additional resources on providing American manufacturers with a competitive advantage in critical, future areas that support advanced technology products and processes. NIST is historically strong in the area of calibration and quantification of data uncertainties of sensors. These new, innovative and complex advanced sensors for manufacturing will all require calibrations so that their signal outputs can be converted to physically relevant quantities manufacturers can then utilize. Furthermore, the physical quantities measured by the sensors need to be validated for their procession and accuracy if the sensors are to be made interchangeable and interoperable.

Schedule and Milestones

Action 1: Advanced Sensing for Manufacturing

- Advance multidimensional and multispectral imaging and scattering measurements of surface, subsurface, and bulk structure for the specification, optimization, and quality control of manufactured components and products.
- Develop in-process and post-process sensing and imaging of surface and subsurface micro and nanostructure, associated defects and interfaces, and surface properties to enable improvements in the reliability and efficiency of advanced manufacturing processes.
- Develop in-process, real-time, high spatial and temporal resolution sensing platforms to control and optimize laser materials processing of semiconductors, metals, and ceramics.

Deliverables

Action 1: Advanced Sensing for Manufacturing

- High-sensitivity, high-throughput inspection methods for nanoscale inspection in microelectronics and optoelectronics manufacturing processes to enable improved process performance, defect detection and quality control, and counterfeit product detection.
- Three-dimensional, non-contact laser imaging methods for the real-time, automated assembly and inspection of product parts in an advanced manufacturing environment.
- In-process and post-process physical and chemical imaging measurements and data on laser materials processing to improve process development and reliability, reduce materials waste, and enable real-time control and optimization.

[9] Complementary Metal-Oxide-Semiconductor. CMOS is the current technology used to construct integrated circuits for today's electronics

Performance Goal: Develop measurement science for advances sensing	FY 2017 Target	FY 2018 Target	FY 2019 Target	FY 2020 Target	FY 2021 Target
With increase	7	7	9	10	10
Without increase	5	7	4	6	6
Description:	Number of new NIST Special Publications, Internal Reports, scientific and technical journal articles, and conference articles and reports.				

Performance Goal: Develop measurement science for advanced sensing	FY 2017 Target	FY 2018 Target	FY 2019 Target	FY 2020 Target	FY 2021 Target
With increase	3	3	2	3	3
Without increase	2	2	1	2	2
Description:	Number of new technical specifications and guidelines developed and published.				

PROGRAM CHANGE PERSONNEL DETAIL

Program: Measurement Science, Services, and Programs
Subprogram: Laboratory Programs
Program Change: Advanced Sensing for Manufacturing

Title:	Grade	Number of Positions	Annual Salary	Total Salaries
Project Managers	ZP IV	7	$108,720	$761,040
Total		7		761,040
Less Lapse	25%	(2)		(190,260)
Total full-time permanent (FTE)		5		570,780
2017 Pay Adjustment (1.6%)				9,132
Total				579,912

Personnel Data	Number
Full-Time Equivalent Employment	
Full-time permanent	5
Other than full-time permanent	0
Total	5
Authorized Positions:	
Full-time permanent	7
Other than full-time permanent	0
Total	7

PROGRAM CHANGE BY OBJECT CLASS
(Dollar amounts in thousands)

Program: Measurement Science, Services, and Programs
Subprogram: Laboratory Programs
Program Change: Advanced Sensing for Manufacturing

	Object Class	FY 2017 Increase	FY 2017 Total Program
11	Personnel compensation		
11.1	Full-time permanent	$580	$227,881
11.3	Other than full-time permanent	0	23,339
11.5	Other personnel compensation	0	1,865
11.8	Special personnel services payments	0	0
11.9	Total personnel compensation	580	253,085
12	Civilian personnel benefits	190	82,562
13	Benefits for former personnel	0	0
21	Travel and transportation of persons	12	10,547
22	Transportation of things	14	1,202
23.1	Rental payments to GSA	0	118
23.2	Rental Payments to others	0	1,655
23.3	Communications, utilities and miscellaneous	257	29,115
24	Printing and reproduction	7	454
25.1	Advisory and assistance services	0	4,407
25.2	Other services	131	30,495
25.3	Purchases of goods & services from Gov't	225	31,426
25.4	Operation and maintenance of facilities	0	0
25.5	Research and development contracts	237	5,327
25.6	Medical care	0	0
25.7	Operation and maintenance of equipment	30	13,257
25.8	Subsistence and support of persons	0	0
26	Supplies and materials	159	35,668
31	Equipment	158	57,321
41	Grants, subsidies and contributions	0	84,203
44	Refunds	0	0
99	Total obligations	2,000	640,842

3. Biomanufacturing/Engineered Biology: Developing Engineering Principles for Efficient Biomanufacturing (Base Funding: $17.5 million and 26 FTE; Program Change: +$2.0 million and +3 FTE)

NIST requests an increase of $2.0 million and 3 FTE to ensure quality and predictability in the design of synthetic biological systems for efficient production of fuels, chemical feedstocks, pharmaceuticals, and medical therapies.

Proposed Actions: Developing engineering principles for efficient biomanufacturing

Biomanufacturing, the use of living organisms to produce a commodity, including fuels, chemicals, pharmaceuticals and medical therapies, has the potential to usher in the next Industrial Revolution into many U.S. manufacturing sectors. There is increasing interest within the federal government to help incentivize the creation of a bio-based economy. Provisions in the 2014 Farm Bill will expand opportunities for growth in advanced biofuels and other biobased product manufacturing efforts. As described in *the Economic Impact of the Biobased Product Industry*[10] report issued by USDA in 2015, these products contribute $369.0 billion and 4 million jobs to the American economy. Medical therapies, also called biologics when produced via a biomanufacturing process and probably the products with the greatest biomanufacturing presence, already account for 50 percent of the revenue from the top 100 drugs in 2014. For biomanufacturing to reach a sustainable maturity in all sectors, however, there are three main hurdles that need to be overcome: reducing the risk of contamination; maintaining high productivity/efficiency, and; reducing product variability among different manufacturing runs. Unlike traditional manufacturing modalities, which often have a number of well-developed, specific process controls and verification steps already integrated into the process, today's biomanufacturing is still using a costly and uncertain trial-and-error approach. This uncertainty also causes a rather unique issue in the regulatory process; biologics cannot be approved by the Food and Drug Administration without concomitant approach of the manufacturing process. This two-phase approval process is implemented because of public safety concerns but creates the unanticipated consequence of restricting future process improvements. A paradigm shift of creating a more reliable, even predictable biomanufacturing process would address all the technological hurdles and help to reduce the uncertainty that currently hampers the regulatory process, most immediately for biologics.

Creating efficient, predictable biomanufacturing processes will require the development of tools to explore, manipulate and ultimately explain the intricate complexities of biological cells. Research in the biological sciences has traditionally relied on a reductionist approach, which suggests that all complex phenomenon can be explained by measuring the most basic components involved. While reductionism has proved to be quite powerful under certain circumstances, this approach of simplification can obfuscate critical, often fundamental, behavior. In an effort to overcome this issue, a new paradigm in the life sciences, commonly referred to as Engineering Biology, has emerged. Instead of measuring individual components, Engineering Biology focuses on the behavior of the whole organism. Engineering Biology seeks to understand, and therefore predict, the rules that govern biological function, and therefore can be used to develop highly stable, calculable biomanufacturing processes.

This initiative addresses the technical challenges faced by the biomanufacturing industry by developing a suite of quantitative methods for accurate measurement of biological systems, creating the necessary tools to methodically design and test engineered organisms, and, by engaging relevant stakeholders, develop and evaluate predictive models where engineered biological systems first be examined *in silico*. Ultimately, a data/analysis system consisting of a community-fed pipeline of highly qualified data will enable researchers to produce experimentally

[10] http://www.biopreferred.gov/BPResources/files/EconomicReport_6_12_2015.pdf

testable predictive theories about biological organisms. This approach has the potential to revolutionize not only biology and biomanufacturing, but all aspects of biomedical science and medicine. This robust approach rooted in high quality data will be essential as the community grapples with the promise of emerging technologies such as human gene editing.

Action 1: Coordinate, develop and assess measurement infrastructure for biological systems

The trial-and-error approach, which is commonly employed in biomanufacturing, is a typical yet ineffective response when techniques to provide accurate, quantitative measurements are not available. Such measurements, however, are critical for understanding how biological systems are controlled on a genetic level. Unfortunately, these types of measurements are difficult because by their very nature, biological cells are inherently "noisy" and interact with the environment in unexpected ways. The biomanufacturing and Engineering Biology research communities have requested NIST's help in providing confidence in the measurements and to establish robustness and harmonization of results. Consequently, NIST is needed to coordinate the strategic development and implementation of accurate and quantitative measurements of engineered biological systems. New, robust measurement technologies will be developed and benchmarking tools for existing techniques will be disseminated. While data generation is important, assessing the data quality is equally critical. Therefore, methods for data validation, including relevant reference data and standards, will be developed. It is envisioned that these efforts will help lead to the generation of sufficient highly qualified datasets, and NIST will assist the community in developing a suitable framework that can help them address their larger (and currently unforeseen) challenges. NIST will also develop a technical roadmap for NIST metrology as it relates to the intersection of biomanufacturing and Engineering Biology.

Action 2: Develop robust design and testing tools for biological systems

The bedrock of Engineering Biology is the ability to manipulate and modify a specific region of genetic material, and then understand how that modification influences the biological organism. Manipulation and modification relies on a detailed understanding what genetic material is present, in what configuration (what is being produced, commonly referred to as the gene or DNA sequence) and how actively that sequence is expressed (how much material is being produced). For example, two DNA sequences may produce different amounts of the same protein. While there are several well-established methods for DNA sequencing, methodologies to accurately quantify DNA expression are currently lacking. This may lead to less-than-optimal design of engineered organisms via the trial-and-error approach and loss of inter-operability among different laboratories. Based on established expertise in gene sequencing, NIST will develop and test standards for DNA modification and synthesis, including assessing the results of DNA modification on gene expression. Such rigorous genetic characterization accompanied by a quantitative functional activity descriptor will enable a better understanding of how biosynthetic pathways function. NIST will also provide high quality data on biological systems engineered with systematic genetic modifications, which can serve as gene expression references for the synthetic biological community to better standardize reporting and promote inter-operability. Further, NIST will focus on robust, high throughput methods for generating large volumes of validated data on gene expression for engineered biological systems. These large data volumes will be available to synthetic biology community for both input and export of genetic designs, which will further assure inter-operability of methods and comparability of results.

Statement of Need and Economic Benefits

Innovations in the biomanufacturing industry are traditionally incremental in nature and often driven by slight refinements to existing technologies.[11] Yet with a potential market share of $1 trillion[12], disruptive technologies and inventions for the biomanufacturing sector are warranted. The intersection of biomanufacturing and Engineering Biology is nascent enough that roadmapping efforts have not yet occurred. Related fields, such as synthetic biology, have begun this effort and are therefore informative of ongoing activities. Beginning in 2013, the United Kingdom's Royal Society and Royal Academy of Engineering, the United States' National Academy of Sciences and National Academy of Engineering, and the Chinese Academy of Science and Chinese Academy of Engineering, collectively organized a series of international symposia on the scientific, technical, and policy issues associated with synthetic biology.[13] More recently, the same group co-hosted the International Summit on Human Gene Editing[14] in Washington, DC in December, 2015. Both of these emerging technology areas are driving increased global investments and the development of formal strategies by governments. Additionally, in Europe, the European Commission and the Organization for Economic Co-operation and Development (OECD) have taken an active interest in these topics. In the U.S., efforts are underway to modernize the regulatory system for biotechnology products. As described in a July 2, 2015 memo[15] from the Executive Office of the President to the heads of the Federal Drug Administration (FDA), Environmental Protection Agency (EPA), and U. S. Department of Agriculture (USDA), it is imperative that we increase the transparency, coordination, predictability, and efficiency of the regulatory system for the products of biotechnology. Advances in our understanding of emerging bioscience and biotechnology areas, and thus our ability to harness their potential for the economy and human health, requires new measurement science methods and a pipeline of high quality data and models. NIST is uniquely positioned to meet this need.

Base Resource Assessment

NIST currently invests about $17.5 million specifically targeted at addressing the measurement challenges in the area of Engineering Biology. These efforts are largely centered in measurement assurance of DNA sequence. NIST has established close and fruitful connections with Defense Advanced Research Projects Agency (DARPA), National Science Foundation (NSF), and academic and industrial collaborators in this arena, and has been active in road-mapping efforts with the synthetic biology community. The proposed program would add capacity in systematic design and measurement of engineered biological response, which in turn would support theoretical work and development of predictive models.

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[11] Gottschalk et al.. 2012. The need for innovation in biomanufacturing. Nature Biotechnology. 30, 489-492.
[12] https://www.bio.org/media/press-release/bio-asks-senate-committee-target-tax-credits-advanced-biofuel-and-renewable-chem
[13] http://sites.nationalacademies.org/pga/stl/synbio_forum/
[14] http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=12032015a
[15] https://www.whitehouse.gov/sites/default/files/microsites/ostp/modernizing_the_reg_system_for_biotech_products_memo_final.pdf

Schedule and Milestones

Action 1: Coordinate, develop and assess measurement infrastructure for biological systems

- Develop advanced measurement methods based on NIST-invented technologies to measure small molecule products from engineered organisms. (FY 2017)
- Convene the synthetic biology community to determine requirements for standards and metrology. (FY 2017 – FY 2021)
- Develop measurement methods at NIST for evaluating sequence fidelity. (FY 2017)
- Develop protocols, reference materials and benchmarking methods and materials for assuring high quality measurements of cell function and products. (FY 2017 – FY 2021)

Action 2: Develop robust design and testing tools for biological systems

- Increase NIST capacity for high content analysis of cell function and cellular products with state of the art equipment and newly recruited personnel. (FY 2017 – FY 2018)
- Design, construct and deploy biological components that allow testing of desired response characteristics and response function in engineered cells. (FY 2018 - FY 2021)

Deliverables

Action 1: Coordinate, develop and assess measurement infrastructure for biological systems

- Develop a technical roadmap for NIST metrology for Engineered Biology for publication in the peer-reviewed literature. (FY 2017)
- Conduct inter-laboratory study of synthesis fidelity. (FY 2018)
- Hold workshop to engage regulatory agencies and stakeholders to identify standards needs for release of engineered organisms. (FY 2019)
- Publish recommendations/guidance for gene synthesis quality. (FY 2019)
- Disseminate relevant benchmarking tools for fluorescence microscopy and flow cytometry to the community. (FY 2019)
- Provide reference data on characteristics and functional activity of selected engineered organisms. (FY 2020 – FY 2021)

Action 2: Develop robust design and testing tools for biological systems

- Develop a robust engineering platform that allows assessment and control of directed evolutionary response in engineered biological systems. (FY2017 – FY 2018)
- Demonstrate a reliable method for inserting large DNA constructs into engineered cells. (FY 2017)
- Develop a platform compatible with microscopy for cell and gene manipulation. (FY 2017 – FY 2018)
- Establish high throughput methods for generating large volumes of validated data on engineered systems. (FY 2018 – FY 2021)
- Develop a model to describe evolution of microbial systems and effect on production. (FY 2018 – FY 2020)

Performance Goals and Measurement Data

Performance Goal: Develop measurement tools for biological systems	FY 2017 Target	FY 2018 Target	FY 2019 Target	FY 2020 Target	FY 2021 Target
With Increase	5	8	10	12	15
Without Increase	3	3	3	3	3

Performance Goal: Develop widely-adopted testing tools for biological systems	FY 2017 Target	FY 2018 Target	FY 2019 Target	FY 2020 Target	FY 2021 Target
With Increase	2	9	12	25	35
Without Increase	2	2	6	8	10

PROGRAM CHANGE PERSONNEL DETAIL
(Dollar amounts in thousands)

Program: Measurement Science, Services, and Programs
Subprogram: Laboratory Programs
Program Change: Biomanufacturing/Engineered Biology

Title:	Location	Grade	Number of Positions	Annual Salary	Total Salaries
Biochemist	Gaithersburg	ZP IV	1	$108,720	$108,720
Biological Engineer	Gaithersburg	ZP IV	1	108,720	108,720
Computational Biologist	Gaithersburg	ZP IV	1	108,720	108,720
Biomedical Engineer	Gaithersburg	ZP IV	1	108,720	108,720
Total			4		434,880
Less Lapse		25%	(1)		(108,720)
Total full-time permanent (FTE)			3		326,160
2017 Pay Adjustment (1.6%)					5,219
TOTAL					331,379

Personnel Data	Number
Full-Time Equivalent Employment	
Full-time permanent	3
Other than full-time permanent	0
Total	3
Authorized Positions:	
Full-time permanent	4
Other than full-time permanent	0
Total	4

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Program: Measurement Science, Services, and Programs
Subprogram: Laboratory Programs
Program Change: Biomanufacturing/Engineered Biology

	Object Class	FY 2017 Increase	FY 2017 Total Program
11	Personnel compensation		
11.1	Full-time permanent	$331	$227,881
11.3	Other than full-time permanent	0	23,339
11.5	Other personnel compensation	0	1,865
11.8	Special personnel services payments	0	0
11.9	Total personnel compensation	331	253,085
12	Civilian personnel benefits	108	82,562
13	Benefits for former personnel	0	0
21	Travel and transportation of persons	14	10,547
22	Transportation of things	9	1,202
23.1	Rental payments to GSA	0	118
23.2	Rental Payments to others	0	1,655
23.3	Communications, utilities and miscellaneous	249	29,115
24	Printing and reproduction	4	454
25.1	Advisory and assistance services	0	4,407
25.2	Other services	145	30,495
25.3	Purchases of goods & services from Gov't	41	31,426
25.4	Operation and maintenance of facilities	0	0
25.5	Research and development contracts	180	5,327
25.6	Medical care	0	0
25.7	Operation and maintenance of equipment	32	13,257
25.8	Subsistence and support of persons	0	0
26	Supplies and materials	127	35,668
31	Equipment	260	57,321
41	Grants, subsidies and contributions	500	84,203
44	Refunds	0	0
99	Total obligations	2,000	640,842

4. Advanced Communications – Addressing the Spectrum Crunch (Base Funding: $12.8 million and 4 FTE; Program Change: + $2.0 million and +4 FTE)

NIST requests $2.0 million and 4 FTE to develop the measurement science and tools necessary to improve spectrum sharing and increase spectrum efficiency of commercial wireless radio-frequency communication systems and to accelerate the deployment of future wireless communications systems that operate at millimeter-wave frequencies.

Proposed Actions

The availability of secure, reliable, high-speed wireless communications is essential for the nation's future economic health and security. Consumers and industry are becoming increasingly reliant on wireless devices to conduct their daily business. In addition, wireless systems are necessary for the development of new technologies in areas as diverse as public safety communications, electrical power grid management, medical devices communications, and advanced manufacturing. According to the 2013 Cisco Visual Networking Index Mobile Forecast, global mobile data traffic will increase by thirteen times and the number of connected mobile devices is estimated to be over 10 billion by 2018. As a result, the radio-frequency spectrum allocated for wireless devices is becoming increasingly congested, making it more difficult for devices to perform efficiently and reliably.

In response to this problem, NIST established the Communications Technology Laboratory (CTL) in 2014 to develop a focused research program for developing the measurement science and standards in support of the communications industry and government agencies as they contend with the spectrum crunch. CTL supports the development of spectrum-efficient and spectrum-sharing wireless technologies for industry and the public-safety sector and helps prepare U.S. industry to develop products that take advantage of spectrum made available by the National Telecommunications and Information Administration (NTIA) and the Federal Communications Commission (FCC).

With the requested funds, NIST will focus its efforts on research that supports industry to develop and deploy advanced communication technologies for both the existing and future frequency spectrum bands allocated for wireless communication systems. These areas include Increased Spectrum Efficiency, and Improved Spectrum Sharing. This initiative will accelerate the Department's ability to achieve the strategy "Foster advanced communications technologies" in Strategic Objective 2.2 in the DOC 2014-2018 Strategic Plan.

Action 1: Increased Spectrum Efficiency ($0.8 million)

In the short term, it is imperative for federal and commercial users of the radio-frequency spectrum to use the currently-allocated frequency bands more efficiently until new spectrum is made available and new spectrum-sharing technologies are developed. Frequency-agile antennas, multiple-antenna arrays, and beam-steering antennas are all forms of adaptive antennas, which are a promising technology for increasing spectrum efficiency. With these new antenna systems, signals can be accurately focused in real time to areas of high wireless usage. This reduces potential interference caused by nearby radiating wireless devices and systems. In order to accurately measure the performance and electrical characteristics of wireless systems that incorporate these new adaptive antenna systems, NIST will extend its current antenna measurement capability by constructing a new multi-purpose, fully-anechoic test chamber. With this new capability, NIST will develop new standardized test methods for characterizing the performance characteristics of

adaptive antennas and provide a facility where industry can test the next generation of adaptive antenna systems prior to their deployment.

Another approach to improving spectrum efficiency is to ensure that digital transmitters and receivers, which are the backbone of mobile wireless communication systems, operate effectively over a very well-defined frequency band. The performance of digital transmitters and receivers can be determined through measurement techniques such as bit-error rate and error-vector magnitude, which can quantify the effects of noise, distortion, and interfering signals that impair the efficiency of digital transmitters and receivers. However, standards do not exist for these important measurement methods. NIST will develop accurate, traceable measurement techniques and will work with standards development organizations to have these methods adopted as standards so that the key performance metrics of digital transmitters and receivers can be accurately determined.

Action 2: Improved Spectrum Sharing ($1.2 million)

New and improved spectrum sharing technologies are promising technologies that can address the spectrum scarcity due to strict, exclusive, and static allocation of frequency bands. These technologies range from access databases that allow sharing on a weekly and daily basis to more dynamic sharing on a millisecond basis. Regardless of the time granularity envisaged, the assumptions for sharing are as follows. Primary users (PUs) are the licensed (or intended) users of the spectrum. In addition to the PUs, secondary users (SUs) can dynamically use the same spectrum as long as they do not cause significant performance degradation for the PUs. Spectrum sharing technologies could benefit many applications, such as in the case of unlicensed devices operating in the TV broadcast bands (white spaces), device to device communications in mobile cellular networks, and sensor networks. Spectrum sharing can also play an important role in unlicensed spectrum as the means to prioritize traffic.

Researchers have worked on various aspects of this relatively new technology and have generated important results. However, despite the impressive theoretical research output, there has been a slow industry adoption, due to a lack of prototype implementations, mature standards, and test environments to validate proposed solutions.

NIST has been developing an evaluation framework for spectrum sharing to investigate its benefits. The requested funds would bolster the development of performance metrics, measurement methods and tools and their successful implementation in a test and evaluation environment. The performance metrics and measurement methods will be used to fully characterize the overall spectrum efficiency and the quality of service measures for the primary and secondary users. Additionally, NIST will work on innovative approaches to spectrum sensing and sharing. As part of this effort, NIST will develop and disseminate simulation models and prototype implementations of key spectrum sharing components. This includes spectrum sensing, control channel architecture, access protocols, and sharing policies. The dissemination of simulation models and software building blocks of key spectrum sharing functions will facilitate research and development of innovative spectrum sharing technologies by others and expedite product development.

Statement of Need and Economic Benefits

Like the interstate highway system or the electrical power grid, the mobile wireless communications system is a critical infrastructure that is an important driver for increasing productivity and accelerating the growth of the nation's economy. In addition, the wireless industry is a source of jobs in the U.S., estimated to be 3.8 million in 2011.

Businesses and consumers are becoming increasingly dependent on wireless devices that require reliable, fast, and secure access to broadband data as well as voice and video services. The variety of wireless devices that access mobile network continues to rapidly increase. In addition to the many tablets, laptops, and smartphones already connected to the network, additional wireless devices now include machine-to-machine connections that are key enablers of applications in the navigation, health-care, electric utilities, manufacturing, and transportation sectors. The proliferation of these wireless connections, numbered at seven billion in 2013, is estimated to grow to over 10 billion by 2018, placing a strain on the already congested frequency spectrum that is allocated to mobile wireless networks.

In its initial response to this future "spectrum crunch", a 2010 Presidential Memorandum directed federal agencies to make additional radio-frequency spectrum available for commercial applications through spectrum auctions and/or reallocation of portions of the federal spectrum. Although this has the potential of reducing spectrum congestion in the short term, government-wide efforts recognized that additional measures were needed to ensure spectrum availability for future wireless systems. Consequently, a Presidential Memorandum (2013) and a report from the President's Council of Advisors on Science and Technology (2012), directed agencies to investigate new technologies for reducing spectrum congestion.

In response to these administrative directives, NIST and NTIA established the Center for Advanced Communications in 2014 to promote interdisciplinary research, development, and testing in radio frequency technology and spectrum sharing for public safety and commercial broadband applications. In 2015, NIST established the National Advanced Spectrum and Communications Test Network to organize a national network of federal, academic, and commercial test facilities that would provide testing, modeling, and analyses necessary to develop and deploy spectrum-sharing technologies.

Schedule and Milestones

Action 1: Increased Spectrum Efficiency

- Develop novel measurement techniques for accurately characterizing the electrical characteristics of adaptive antenna systems used to increase spectrum efficiency. (FY 2017 – FY 2020)
- Identify key performance metrics and develop measurement techniques for accurately characterizing the electrical performance of digital receivers and transmitters. (FY 2017 – FY 2019)

Action 2: Improved Spectrum Access

- Research and develop novel spectrum sharing techniques and components including spectrum sensing, channel control, spectrum management policy, and network access protocols. (FY 2017 – FY 2019)
- Test and evaluate emerging proposals for spectrum sharing technologies; disseminate evaluation results and measurements methods and tools. (FY 2017 – FY 2020)

- Work with industry to define and promulgate consensus standards for spectrum sharing technologies and to ensure the rapid adoption and deployment of these standard technologies into commercial networks. (FY 2017 – FY 2020)

Deliverables

Action 1: Increased Spectrum Efficiency

- Standards and best practice guides that document how to accurately measure the high-frequency electrical performance of broadband digital receivers and transmitters.
- Measurement methods for waveform metrology that industry could use to access the accuracy of vector receivers used in the communications industry.

Action 2: Improved Spectrum Access

- Metrics and measurement methods for assessing the performance of spectrum sharing.
- Modeling tools that enable researchers to accurately characterize the behavior and performance of spectrum sharing technologies.
- Software building blocks of key components of spectrum sharing technologies to enable rapid prototype implementation and to expedite the product development cycle and the commercial deployment.
- Published analyses and improved standards for emerging spectrum sharing technology specifications.

Performance Goals and Measurement Data:

Performance Goal: Publications	FY 2017 Target	FY 2018 Target	FY 2019 Target	FY 2020 Target	FY 2021 Target
With increase	12	14	16	18	20
Without increase	10	10	10	10	10
Description:	Number of new NIST Special Publications, Internal Reports, Professional conference and journal articles, standard technical contributions annually.				

Performance Goal: Test & Measurement Tools	FY 2017 Target	FY 2018 Target	FY 2019 Target	FY 2020 Target	FY 2021 Target
With increase	10	11	12	13	14
Without increase	5	5	5	5	5
Description:	Number of models, test and measurement tools released to public use annually.				

PROGRAM CHANGE PERSONNEL DETAIL
(Dollar amounts in thousands)

Program: Measurement Science, Services, and Programs
Subprogram: Laboratory Programs
Program Change: Advanced Communications

Title:	Location	Grade	Number of Positions	Annual Salary	Total Salaries
Electrical Engineer	Boulder	ZP III	1	$77,371	$77,371
Electronics Engineer	Boulder	ZP III	1	77,371	77,371
Computer Scientist	Boulder	ZP III	1	77,371	77,371
Information Technology Specialist	Boulder	ZP III	1	77,371	77,371
Mathematical Statistician	Boulder	ZP III	1	77,371	77,371
Total			5		386,855
Less Lapse		25%	(1)		(96,714)
Total full-time permanent (FTE)			4		290,141
2017 Pay Adjustment (1.6%)					4,642
TOTAL					294,783

Personnel Data	Number
Full-Time Equivalent Employment	
Full-time permanent	4
Other than full-time permanent	0
Total	4
Authorized Positions:	
Full-time permanent	5
Other than full-time permanent	0
Total	5

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Program: Measurement Science, Services, and Programs
Subprogram: Laboratory Programs
Program Change: Advanced Communications

	Object Class	2017 Increase	FY 2017 Total Program
11	Personnel compensation		
11.1	Full-time permanent	$295	$227,881
11.3	Other than full-time permanent	0	23,339
11.5	Other personnel compensation	0	1,865
11.8	Special personnel services payments	0	0
11.9	Total personnel compensation	295	253,085
12	Civilian personnel benefits	96	82,562
13	Benefits for former personnel	0	0
21	Travel and transportation of persons	11	10,547
22	Transportation of things	12	1,202
23.1	Rental payments to GSA	0	118
23.2	Rental Payments to others	0	1,655
23.3	Communications, utilities and miscellaneous charges	255	29,115
24	Printing and reproduction	5	454
25.1	Advisory and assistance services	0	4,407
25.2	Other services	395	30,495
25.3	Purchases of goods & services from Gov't accounts	21	31,426
25.4	Operation and maintenance of facilities	0	0
25.5	Research and development contracts	400	5,327
25.6	Medical care	0	0
25.7	Operation and maintenance of equipment	40	13,257
25.8	Subsistence and support of persons	0	0
26	Supplies and materials	260	35,668
31	Equipment	110	57,321
32	Lands and structures	0	0
33	Investments and loans	0	0
41	Grants, subsidies and contributions	100	84,203
42	Insurance claims and indemnities	0	0
43	Interest and dividends	0	0
44	Refunds	0	0
99	Total obligations	2,000	640,842

5. Ensuring a World Class Neutron Research Facility (Base Funding: $46.8 million and 171 FTE; Program Change: +$4.8 million and +0 FTE)

NIST requests an increase of $4.8 million to procure sufficient fuel to operate fully the NIST Center for Neutron Research reactor, thus ensuring that NIST continues to provide a world-class neutron research facility, providing access to sophisticated measurement tools that can be used by industry.

Enhancing industrial competitiveness with a world-class neutron research facility

Growing the economy, improving industrial competiveness, and developing the products of tomorrow require providing industry with access to sophisticated measurement tools enabling researchers to find solutions to problems quickly. Neutrons have been enormously successful as a unique probe of the structure and dynamics of materials for researchers from many different backgrounds, including academia and industry. Neutrons can provide information that simply cannot be obtained using more conventional methods available in the researchers' own laboratories. Worldwide, the demand for access to neutron measurement capabilities far exceeds the supply, and the NIST Center for Neutron Research (NCNR) is the only U.S. facility with a focus on enhancing industrial competitiveness. It is therefore essential to U.S. industry, and the long-term economic growth of the U.S., that the NCNR is optimally equipped to provide state-of-the-art measurement tools to the U.S. scientific and engineering community.

The NCNR will maintain and grow its high quality facility to address the neutron supply-demand mismatch by investing in a lifetime extension of the source facility to maintain reliable operations and high availability to the end users. The investment will ensure the high reliability and availability of the facility by obtaining an adequate supply of reactor fuel and supports NIST's capacity to grow innovation-intensive economic sectors in support of the DOC Strategic Plan Objective 2.5 and supports the development of partnerships and collaborations as identified in the DOC Strategic Plan Strategic Objective 2.1.

Action: Lifetime extension of the source facility to maintain reliable operations and high availability to the end users

Reactor fuel manufacturing and shipping: $4.8 million per year is requested to enable NIST to procure sufficient fuel to ensure the availability of reactor fuel for sustained operations. At its current capacity NCNR uses 28 fuel elements annually. These funds will enable NIST to continue to support domestic fuel production and ensure that the NCNR can continue operations for the foreseeable future.

The NCNR uses a 20 MW research reactor as a neutron source. The reactor operates 24 hours a day, seven days a week for approximately 250 days of the year to support experiments by over 2,000 research participants annually. It is critical that the research reactor operates safely and reliably in order to support the NCNR mission to develop and provide advanced neutron measurement techniques and instrumentation for research. Costs to maintain, upgrade or replace reactor systems as well as costs for reactor fuel have increased significantly. For example, the cost to procure an individual reactor fuel element rose from $32,500 in 2002 to $94,060 a decade later in 2013, and it is estimated to be over $150,000 in 2015. Due to these continued rising costs, NIST is requesting funds to buy fuel in quantity, in order to maintain the high availability and reliability of the source for the NCNR users.

Statement of Need and Economic Benefits

Investments in neutron science at NIST will enable industry researchers to study and develop new materials and products. Neutrons have been enormously successful as a unique probe of the structure and dynamics of materials under a broad range of such conditions including stress, shear, flow, high and low temperatures, and magnetic field. Paint, a $25.0 billion industry in the U.S., is an example of a material that has been engineered to exhibit specific properties under shear and neutrons have been essential in developing the understanding leading to improved performance. Pharmaceutical companies, a $340.0 billion industry in the U.S., use neutron scattering as an essential tool for the development of biopharmaceuticals, requiring more varied processing equipment (e.g. for complex flow conditions) to be available for beam-line research. In each case neutrons provide industry with information that simply cannot be obtained using more conventional methods.

Unfortunately the demand for access to neutron measurement capabilities far exceeds the supply. In the U.S. there are only three remaining sites that provide such measurement capabilities. One of the nation's facilities is scheduled to be de-funded in FY 2015, which will further reduce the total U.S. measurement capacity and significantly exacerbate the supply-demand mismatch.

Base Resources Assessment

The NCNR is the only U.S. facility with a mission to focus on enhancing industrial competitiveness. It is therefore essential to U.S. industry, and the long-term economic growth of the U.S., that the NCNR is optimally equipped to provide state-of-the-art measurement tools to the U.S. scientific and engineering community. With the recent completion of a major expansion, about two dozen instruments are available at the NCNR alongside a high quality technical staff. The 2013 National Research Council assessment identified the NCNR as a premier neutron science user facility and noted "NCNR's high scientific productivity is due, in part, to effective communication between the management and staff and with the internal and external user communities." The NCNR provides several access modes for neutron research, ranging from peer-reviewed proposals to industry partnerships, proprietary research, and through consortia – such as nSoft that is providing access to leading companies such as Dow, Kimberly-Clark, and Medimmune. Over 2,000 research participants annually produce 300 publications based on research conducted at the NCNR, which also results in about 40 PhDs annually and a number of summer students who spend time on the NIST site learning about neutron science.

Schedule and Milestones

Lifetime extension of the source facility to maintain reliable operations and high availability to the end users.

- Purchase of reactor fuel to enable sustained NCNR operations. (FY 2017 - FY 2021)

Deliverables

Lifetime extension of the source facility to maintain reliable operations and high availability to the end users.

- High availability and reliability of the neutron facility for NCNR users by ensuring adequate fuel supply.

Performance goals and Measurement Data

Performance Goal: Adequate fuel supply to maintain the high availability and reliability of facility to scientific community.	FY 2017 Target	FY 2018 Target	FY 2019 Target	FY 2020 Target	FY 2021 Target
With increase	5%	20%	25%	50%	100%
Without increase	0	0	0	0	0
Description:	Adequate fuel supply will be obtained, thus maintaining the high availability and reliability of the facility to the scientific community.				

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Program: Measurement Science, Services, and Programs
Subprogram: Laboratory Programs
Program Change: Ensuring a World Class Neutron Research Facility

	Object Class	FY 2017 Increase	FY 2017 Total Program
11	Personnel compensation		
11.1	Full-time permanent	0	$227,881
11.3	Other than full-time permanent	0	23,339
11.5	Other personnel compensation	0	1,865
11.8	Special personnel services payments	0	0
11.9	Total personnel compensation	0	253,085
12	Civilian personnel benefits	0	82,562
13	Benefits for former personnel	0	0
21	Travel and transportation of persons	$13	10,547
22	Transportation of things	4	1,202
23.1	Rental payments to GSA	0	118
23.2	Rental Payments to others	0	1,655
23.3	Communications, utilities and miscellaneous	584	29,115
24	Printing and reproduction	2	454
25.1	Advisory and assistance services	0	4,407
25.2	Other services	289	30,495
25.3	Purchases of goods & services from Gov't	3,767	31,426
25.4	Operation and maintenance of facilities	0	0
25.5	Research and development contracts	0	5,327
25.6	Medical care	0	0
25.7	Operation and maintenance of equipment	52	13,257
25.8	Subsistence and support of persons	0	0
26	Supplies and materials	65	35,668
31	Equipment	24	57,321
41	Grants, subsidies and contributions	0	84,203
44	Refunds	0	0
99	Total obligations	4,800	640,842

6. Lab to Market/Technology Transfer: Expand Technology Transfer Activities to Leverage Existing Authorities to Promote Data Sharing Efforts (Base Funding $6.0 million and 10 FTE; Program Change: +$2.0 million and +0 FTE)

NIST requests an increase of $2.0 million to expand lab to market and technology transfer activities through the development and deployment of data sharing and collaborative tools and services.

Proposed Actions: Enable the Development of Laboratory to Market/Technology Transfer Tools to Enhance and Promote Data Sharing

The U.S. invests more than $135.0 billion annually in research and development. A wide range of life-changing commercial technologies were nurtured by such federally funded R&D. Federally-funded R&D has historically led to dramatic economic growth, and there is potential to increase the public's return on this investment in terms of innovation, job creation, societal impact, and economic prosperity. To fully realize this impact, the transfer of technology resulting from this investment to U.S. businesses must be accelerated. Through efforts under the Presidential Memorandum – Accelerating Technology Transfer and Commercialization of Federal Research in Support of High-Growth Businesses and the Lab to Market Cross Agency Priority Goal, great progress is being made. However, there remains work to be done to implement cross-agency solutions and develop interagency tools that support these activities. Such a coordinated approach will better leverage the entire research portfolio than the current piecemeal approach. Specifically, NIST will lead the development of infrastructures for information sharing, data dissemination, and increase collaborations to address national priorities and enhance business competitiveness. This initiative will strengthen NIST and Federal Technology Transfer activities through the following efforts:

Action 1: Develop Interagency Platform for Complementary Technology

NIST will work with the Federal Laboratory Consortium (FLC) and offices within the Executive Office of the President (EOP), including the use of the EOP Presidential Innovation Fellows program to lead the development of digital platforms to enhance cross-agency collaborations on technology transfer and development. Building on efforts to streamline access to tangible and intangible assets from the federally funded R&D enterprise, these digital platforms will increase visibility of and connectivity between those assets. They will promote collaboration between agencies on specific national priority technology areas, enabling stakeholders to identify available, complementary technology components, thus accelerating development of new technological systems. Such an infrastructure would also enable large-scale dissemination of information while providing advanced capabilities to collect and organize information in ways that better address national priorities and business needs. Such organization, searching, and collaborative capabilities are necessary, since advanced products are often not the result of a single technology, but are rather a combination of often dozens of technologies. As they develop, these platforms will expand to enable data sharing and synchronization across government, non-profit, and for-profit platforms.

Statement of Need and Economic Benefits

A wide range of life-changing commercial technologies were nurtured by federally funded research and development (R&D), from the Internet, to the global positioning system (GPS), to leading-edge vaccines. The federal R&D enterprise must continue to support fundamental research that is motivated primarily by our interest in expanding the frontiers of human knowledge, and diffusing this knowledge through easy to access data and publications.

At the same time, federally funded R&D has historically led to dramatic economic growth, and there is significant potential to increase the public's return on this investment in terms of innovation, job creation, societal impact, competitiveness, and economic prosperity.

This action will require coordination across all departments and agencies that fund research and development (both intramural and extramural), consistent with each agency's mission. Implementation will include the preparation of government-wide plans and will be coordinated with executive offices and the Interagency Workgroup on Technology Transfer, established pursuant to Executive Order 12591 of April 10, 1987.

Base Resource Assessment

This effort will expand upon base resources provided in FY 2016 to fund lab to market activities. Existing funding across agencies is dispersed and there is a need to centralize the development of cross-agency solutions to address these issues. NIST currently chairs interagency workgroups to develop and coordinate policies in technology transfer across government agencies for both intramural and extramural programs and has authority to develop regulations in the area of Federal Technology Transfer. NIST also serves as the host agency for the Federal Laboratory Consortium for Technology Transfer. This leadership position makes NIST the ideal place to implement these programs and to further strengthen NIST's role in enabling coordination and cooperation across the federal enterprise.

Schedule and Milestones

Action 1: Develop Platform for Complementary Technologies

- Coordinate cross-agency system requirements.
- Identify initial candidates of national issues to serve as system pilot.
- Coordinate with agency and laboratory technology transfer offices to identify potential technology solutions linked to the problem and build tools to link data.
- Coordinate with stakeholders at universities and the private sector to identify and integrate best practices.

Deliverables

Action 1: Develop Platform for Complementary Technologies

- Deploy platform that allows for agencies to connect technologies and solutions to identified technology problems.
- Allow for the connection of complementary technology solutions across agencies to deliver a package of technologies that address an identified technology problem.

Performance Goals and Measurement Data

Performance goal: Number of technology areas addressed	FY 2017 Target	FY 2018 Target	FY 2019 Target	FY 2020 Target	FY 2021 Target
With Increase	5	5	5	5	5
Without Increase	0	0	0	0	0
Description: Development of complementary technology system and populate problems and technologies					

PROGRAM CHANGE BY OBJECT CLASS
(Dollar amounts in thousands)

Program: Measurement Science, Services, and Programs
Subprogram: Standards Coordination and Special Programs
Program Change: Labs to Market/Technology Transfer

	Object Class	FY 2017 Increase	FY 2017 Total Program
11	Personnel compensation		
11.1	Full-time permanent	0	$14,221
11.3	Other than full-time permanent	0	989
11.5	Other personnel compensation	0	2,832
11.8	Special personnel services payments	0	0
11.9	Total personnel compensation	0	18,042
12	Civilian personnel benefits	0	5,770
13	Benefits for former personnel	0	0
21	Travel and transportation of persons	0	1,391
22	Transportation of things	0	72
23.1	Rental payments to GSA	0	0
23.2	Rental Payments to others	0	206
23.3	Communications, utilities and miscellaneous	0	5,430
24	Printing and reproduction	0	95
25.1	Advisory and assistance services	$1,000	1,310
25.2	Other services	0	10,084
25.3	Purchases of goods & services from Gov't	0	2,305
25.4	Operation and maintenance of facilities	0	0
25.5	Research and development contracts	1,000	3,548
25.6	Medical care	0	0
25.7	Operation and maintenance of equipment	0	1,409
25.8	Subsistence and support of persons	0	0
26	Supplies and materials	0	2,937
31	Equipment	0	2,016
41	Grants, subsidies and contributions	0	18,687
44	Refunds	0	0
99	Total obligations	2,000	73,302

7a. Departmental Working Capital Fund Increase (+$872 thousand and 0 FTE) - Laboratory Programs

The $872 thousand will cover additional shared service investments within the Departmental Working Capital Fund (WCF). These Departmental requirements include necessary investments in Department-wide systems, network security initiatives and replacement of degrading IT infrastructure. A full discussion of all WCF program changes can be found in the WCF section of the Departmental Management.

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Budget Program: Measurement Science, Services, and Programs
Subprogram: Laboratory Programs
Program Change: Departmental Working Capital Fund Increase

	Object Class	FY 2017 Increase	FY 2017 Total Program
11	Personnel compensation		
11.1	Full-time permanent	0	$227,881
11.3	Other than full-time permanent	0	23,339
11.5	Other personnel compensation	0	1,865
11.8	Special personnel services payments	0	0
11.9	Total personnel compensation	0	253,085
12	Civilian personnel benefits	0	82,562
13	Benefits for former personnel	0	0
21	Travel and transportation of persons	0	10,547
22	Transportation of things	0	1,202
23.1	Rental payments to GSA	0	118
23.2	Rental Payments to others	0	1,655
23.3	Communications, utilities and miscellaneous	0	29,115
24	Printing and reproduction	0	454
25.1	Advisory and assistance services	0	4,407
25.2	Other services	0	30,495
25.3	Purchases of goods & services from Gov't	$872	31,426
25.4	Operation and maintenance of facilities	0	0
25.5	Research and development contracts	0	5,327
25.6	Medical care	0	0
25.7	Operation and maintenance of equipment	0	13,257
25.8	Subsistence and support of persons	0	0
26	Supplies and materials	0	35,668
31	Equipment	0	57,321
41	Grants, subsidies and contributions	0	84,203
44	Refunds	0	0
99	Total obligations	872	640,842

7b. Departmental Working Capital Fund Increase (+$23 thousand and 0 FTE) – Corporate Services

The $23 thousand will cover additional shared service investments within the Departmental Working Capital Fund (WCF). These Departmental requirements include necessary investments in Department-wide systems, network security initiatives and replacement of degrading IT infrastructure. A full discussion of all WCF program changes can be found in the WCF section of the Departmental Management.

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Budget Program: Measurement Science, Services, and Programs
Subprogram: Corporate Services
Program Change: Departmental Working Capital Fund Increase

	Object Class	FY 2017 Increase	FY 2017 Total Program
11	Personnel compensation		
11.1	Full-time permanent	0	$3,727
11.3	Other than full-time permanent	0	265
11.5	Other personnel compensation	0	856
11.8	Special personnel services payments	0	0
11.9	Total personnel compensation	0	4,848
12	Civilian personnel benefits	0	1,436
13	Benefits for former personnel	0	0
21	Travel and transportation of persons	0	23
22	Transportation of things	0	0
23.1	Rental payments to GSA	0	0
23.2	Rental Payments to others	0	10
23.3	Communications, utilities and miscellaneous	0	1,293
24	Printing and reproduction	0	2
25.1	Advisory and assistance services	0	306
25.2	Other services	0	5,617
25.3	Purchases of goods & services from Gov't	$23	5,768
25.4	Operation and maintenance of facilities	0	0
25.5	Research and development contracts	0	0
25.6	Medical care	0	0
25.7	Operation and maintenance of equipment	0	1,196
25.8	Subsistence and support of persons	0	0
26	Supplies and materials	0	0
31	Equipment	0	889
41	Grants, subsidies and contributions	0	0
44	Refunds	0	0
99	Total obligations	23	21,388

7c. Departmental Working Capital Fund Increase (+$100 thousand and 0 FTE) - Standards Coordination and Special Programs

The $100 thousand will cover additional shared service investments within the Departmental Working Capital Fund (WCF). These Departmental requirements include necessary investments in Department-wide systems, network security initiatives and replacement of degrading IT infrastructure. A full discussion of all WCF program changes can be found in the WCF section of the Departmental Management.

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Budget Program: Measurement Science, Services, and Programs
Subprogram: Standards Coordination and Special Programs
Program Change: Departmental Working Capital Fund Increase

	Object Class	FY 2017 Increase	FY 2017 Total Program
11	Personnel compensation		
11.1	Full-time permanent	0	$14,221
11.3	Other than full-time permanent	0	989
11.5	Other personnel compensation	0	2,832
11.8	Special personnel services payments	0	0
11.9	Total personnel compensation	0	18,042
12	Civilian personnel benefits	0	5,770
13	Benefits for former personnel	0	0
21	Travel and transportation of persons	0	1,391
22	Transportation of things	0	72
23.1	Rental payments to GSA	0	0
23.2	Rental Payments to others	0	206
23.3	Communications, utilities and miscellaneous	0	5,430
24	Printing and reproduction	0	95
25.1	Advisory and assistance services	0	1,310
25.2	Other services	0	10,084
25.3	Purchases of goods & services from Gov't	$100	2,305
25.4	Operation and maintenance of facilities	0	0
25.5	Research and development contracts	0	3,548
25.6	Medical care	0	0
25.7	Operation and maintenance of equipment	0	1,409
25.8	Subsistence and support of persons	0	0
26	Supplies and materials	0	2,937
31	Equipment	0	2,016
41	Grants, subsidies and contributions	0	18,687
44	Refunds	0	0
99	Total obligations	100	73,302

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Exhibit 16

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

	Object Class	2015 Actual	2016 Enacted	2017 Base	2017 Estimate	Increase/ (Decrease) Over 2017 Base
11	Personnel compensation					
11.1	Full-time permanent	$229,489	$239,292	$242,692	$245,829	$3,137
11.3	Other than full-time permanent	24,094	24,414	24,593	24,593	0
11.5	Other personnel compensation	5,553	5,553	5,553	5,553	0
11.9	Total personnel compensation	259,136	269,259	272,838	275,975	3,137
12.1	Civilian personnel benefits	79,509	84,674	88,743	89,768	1,025
13	Benefits for former personnel	0	0	0	0	0
21	Travel and transportation of persons	10,307	10,235	11,750	11,961	211
22	Transportation of things	1,122	1,195	1,217	1,274	57
23.1	Rental payments to GSA	43	120	118	118	0
23.2	Rental payments to others	1,324	1,838	1,871	1,871	0
23.3	Communications, utilities, and miscellaneous charges	25,708	33,999	32,823	35,838	3,015
24	Printing and reproduction	453	510	519	551	32
25.1	Advisory and assistance services	5,514	4,911	5,023	6,023	1,000
25.2	Other services	77,233	72,315	39,920	46,196	6,276
25.3	Purchases of goods and services from Government accounts	25,896	28,667	33,508	39,499	5,991
25.5	Research and development contracts	3,316	5,582	5,683	8,875	3,192
25.7	Operation and maintenance of equipment	16,524	15,287	15,562	15,862	300
26	Supplies and materials	33,826	36,633	37,492	38,605	1,113
31	Equipment	50,462	55,713	58,606	60,226	1,620
32	Land and structures	0	0	0	0	0
41	Grants, subsidies, and contributions	107,047	98,490	98,490	102,890	4,400
42	Insurance claims and indemnities	1	0	0	0	0
43	Interest and dividends	30	0	0	0	0
99	Total Obligations	697,451	719,428	704,163	735,532	31,369

	Object Class	2015 Actual	2016 Enacted	2017 Base	2017 Estimate	Increase/ (Decrease) Over 2017 Base
99	Total Obligations	697,451	719,428	704,163	735,532	31,369
	Less Prior Year Recoveries	(5,327)	(1,000)	(1,000)	(1,000)	0
	Less Prior Year Refunds	(53)				
	Less Prior Year Unobligated Balance	(33,551)	(22,928)	0	0	0
	Plus Unobligated Balance, End of Year	22,928				
	Plus Unobligated Balance, Expired	2				
	Total Budget Authority	681,450	695,500	703,163	734,532	31,369
	Transfer to DoC Working Capital for HCHB renovation.	450				
	Transfer to NIST Working Capital Fund	0	500	0	500	500
	Transfer from Election Assistance Commission	(1,900)	(1,500)	0	(1,500)	(1,500)
	Transfers from DoJ for forensic sciences and Office of Law Enforcement Standards	(4,500)	(4,500)	0	(2,999)	(2,999)
	Appropriation	675,500	690,000	703,163	730,533	27,370

Personnel Data

Full-time equivalent employment:					
Full-time permanent	2,100	2,204	2,219	2,250	31
Other than full-time permanent	273	273	273	273	0
Total	2,373	2,477	2,492	2,523	31
Authorized Positions:					
Full-time permanent	2,355	2,424	2,424	2,465	41
Other than full-time permanent	57	57	57	57	0
Total	2,412	2,481	2,481	2,522	41

Exhibit 23

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

IT Projects by Activity/Subactivity: (Totals by Activity)	Unique Investment Identifier	IT Investment Title	2015 Actual	2016 Enacted	2017 Estimate	Increase/ Decrease
NIST Laboratories						
	006-000701100	NIST Administrative Support	$3,308	$3,405	$3,501	$96
	006-000704500	NIST Central IT Support for Science	1,897	1,954	2,011	57
	006-000702100	NIST Laboratories	27,902	28,809	29,739	930
	006-000702200	NIST IT Intrastructure and Office Automation	11,561	11,869	12,187	318
Total			44,668	46,037	47,438	1,401

Department of Commerce
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.

P.L. 110-143 121 STAT 1809 provides NIST to assist in developing a research program to establish guidelines for the remediation of former methamphetamine laboratories in the United States as well as developing new detection technologies and appropriate Standard Reference Materials for methamphetamine detection testing.

2. $730,533,000, to remain available until expended,

no specific authority

3. of which not to exceed $9,000,000 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".

4. Public Law 110-69, America Competes Act, 121 Stat 572, passed August 9, 2007 reauthorizes the Scientific and Technical Research and Services appropriation through 2010. Public Law 111-358, America Competes Reauthorization Act, 2010, 124 Stat 3982, passed January 4, 2011 reauthorized the Scientific and Technical Research and Standards appropriation through 2013. In addition, an Emergency Communication and Tracking Technologies Research initiative and a Green Manufacturing and Construction initiative were authorized to develop advanced technologies in these areas.

5. Public Law 111-5 American Recovery and Reinvestment Act of 2009 appropriates $220,000,000 for the Scientific and Technical Research and Services appropriation from FY 2009 to FY 2010 and makes available by reimbursable agreement $10,000,000 from the Department of Energy for the development of Smart Grid Technology by reference to Public Law 110-140, the Energy Independence and Security Act of 2007, and makes available by reimbursable agreement $2,230,186 for a service level agreement with the National Telecommunications and Information Administration. In addition, $20,000,000 is transferred from the Department of Health and Human Services for continued work on advancing health care information enterprise integration.

6. Public Law 113-274 Cybersecurity Enhancement Act of 2014 amended Section 2c of the National Institute of Standards and Technology Act (15 U.S.C. 272(c) and established a Public-Private collaboration on Cybersecurity by designating the Director of the Institute activities that facilitate and support on an ongoing basis the development of a voluntary, consensus-based, industry-led set of standards, guidelines, best practices, methodologies, procedures, and processes to cost-effectively reduce cyber risks to the critical infrastructure of the United States.

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

	FY 2015 Actual	FY 2016 Estimate	FY 2017 Estimate
Management and professional support services	$3,328	$2,275	$2,337
Studies, analyses, and evaluations	220	222	233
Engineering and technical services	1,966	2,414	3,453
Total	5,514	4,911	6,023

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.

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Industrial
Technology Services

Department of Commerce
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
2016 Enacted	97	97	$155,000	$184,900	$155,000
less: Unobligated balance from prior year			0	(21,400)	0
2017 Adjustments to base:					
Adjustments:					
Other Changes:					
Annualization of positions financed in FY 2016	0	3	0	0	0
AMTech Decrease		(4)			
TIP shutdown	0	(1)	0	0	0
plus: Inflationary cost changes	0	0	977	977	977
less: Estimated recoveries 2016	0	0	0	(8,500)	0
2017 Base Request	97	95	155,977	155,977	155,977
plus: 2017 Program changes	2	1	33,014	33,014	33,014
2017 Estimate	99	96	188,991	188,991	188,991

		2015 Actual		2016 Enacted		2017 Base		2017 Estimate		Increase/ (Decrease) Over 2017 Base	
Comparison by program/sub-program:		Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount
Technology innovation program											
Technology innovation program	Pos./Approp	0	0	0	0	0	0	0	0	0	0
	FTE/Obl.	3	$814	1	$4,635	0	0	0	0	0	0
Advanced manufacturing technology consortia											
Advanced manufacturing technology consortia	Pos./Approp	4	8,100	0	0	0	0	0	0	0	0
	FTE/Obl.	11	11,710	0	0	0	0	0	0	0	0
Hollings manufacturing extension partnership											
Hollings manufacturing extension partnership	Pos./Approp	81	130,000	81	130,000	81	$130,928	81	$141,991	0	$11,063
	FTE/Obl.	66	144,556	80	151,925	80	130,928	80	141,991	0	11,063
National network for manufacturing innovation											
National network for manufacturing innovation	Pos/Approp	0	0	16	25,000	16	25,049 [2/]	18	47,000	2	21,951
	FTE/Obl.	0	0	16	28,277 [1/]	15	25,049	16	47,000	1	21,951
Baldrige performance excellence program											
Baldrige performance excellence program	Pos./Approp	0	0	0	0	0	0	0	0	0	0
	FTE/Obl.	0	0	0	63	0	0	0	0	0	0
TOTALS	Pos./Approp	85	138,100	97	155,000	97	155,977	99	188,991	2	33,014
	FTE/Obl.	80	157,080	97	184,900	95	155,977	96	188,991	1	33,014

Comparison by program/sub-program:	2015 Actual		2016 Enacted		2017 Base		2017 Estimate		Increase/ (Decrease) Over 2017 Base	
	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount
Adjustments for:										
Recoveries		(5,974)		(8,500)		0		0		0
Refunds		(911)		0		0		0		0
Unobligated balance, start of year		(33,495)		(21,400)		0		0		0
Unobligated balance, end of year		21,400		0		0		0		0
Budget Authority/Appropriation		138,100		155,000		155,977		188,991		33,014

[1/] The NNMI obligation amount of $28,277K includes $3,277K of AMTech carryover.

[2/] The FY 2017 base amount was adjusted for the FY 2017 share of ATBs ($49K).

Exhibit 9

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

	FTE	Amount
Other Changes:		
Annualization of 2016 pay raise	0	33

A pay raise of 1.3 percent is assumed to be effective January 1, 2016.

Total cost in FY 2017 of 2016 pay raise	$ 130,667
Less amount requested in FY 2016	(98,000)
Less amount absorbed in FY 2016	0
Amount requested in 2017 to provide full-year cost of 2016 pay raise	32,667

2017 Pay increase and related costs	0	153

A general pay raise of 1.6 percent is assumed to be effective January 1, 2017.

Total cost in FY 2017 of pay increase	$ 153,000
Less amount absorbed in FY 2017	0
Amount requested for FY 2017 pay increase	153,000
Payment to Departmental Management Working Capital Fund	0
Total adjustment for FY 2017 pay increase	153,000

Annualization of positions financed in FY 2016 ..... (2) 0

Due to the TIP program shutdown, and program adjustments occurring within ITS, two FTE's are decreased.

New positions reduced in 2016	(3)
Less 5 percent lapse	(0)
Full-Year FTE	(3)
Less FTE funded in 2016	1
Annualization of Positions/FTE in 2017	(2)

Change in compensable days 0 (98)

The decreased cost of one more compensable day in FY 2017 compared to FY 2016 is calculated by dividing the FY 2016 estimated personnel compensation ($10,306,000) and applicable benefits ($2,505,000) by 262 compensable days. The cost decrease of two less compensable days is $97,794.

Personnel benefits. 0 124

Civil Service Retirement System (CSRS)	(19)
Federal Employees' Retirement System (FERS)	86
Thrift Savings Plan (TSP)	13
Federal Insurance Contribution Act (FICA) – OASDI	25
Health Insurance	22
Employees Compensation Fund	(3)

Civil Service Retirement System (-$19,000) – 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 4.9 percent in FY 2016 to 2.3 percent in FY 2017. The contribution rate will remain at 7.0 percent in FY 2017.

Payroll subject to retirement systems ($10,295,694)	
Cost of CSRS contributions in FY 2017 ($10,295,694 x .023 x .07)	$ 16,576
Cost of CSRS contributions in FY 2016 ($10,295,694 x .049 x .07)	35,314
Total adjustment to base	(18,738)

Federal Employees' Retirement System ($86,000) – 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 95.1 percent in FY 2016 to 97.7 percent in FY 2017.

Payroll subject to retirement systems ($10,295,694)	
Basic benefit cost in FY 2017 ($10,295,694 x .977 x .137)	$1,378,068
Basic benefit cost in FY 2016 ($10,295,694 x .951 x .132)	1,292,439
Total adjustment to base	85,629

Thrift Savings Plan ($13,000) – The cost of agency contributions to the Thrift Savings Plan will also rise as FERS participation increases. The contribution rate increased from 4.62 percent in FY 2016 to 4.63 percent in FY 2017.

Thrift plan cost in FY 2017 ($10,295,694 x .977 x .0463)	$ 465,727
Thrift plan cost in FY 2016 ($10,295,694 x .951 x .0462)	452,354
Total adjustment to base	13,373

Federal Insurance Contributions Act (FICA) - OASDI ($25,000) – As the percentage of payroll covered by FERS increases, the cost of OASDI contributions will increase. In FY 2016, the maximum salary subject to OASDI tax was $119,100 and will increase to $126,200 in FY 2017. The OASDI tax rate for employers remains at 6.2 percent in FY 2017.

FERS payroll subject to FICA tax in 2017 ($10,295,694 x .977 x .920 x .062)	$ 573,759
FERS payroll subject to FICA tax in 2016 ($10,295,694 x .951 x .904 x .062)	548,777
Increase (FY 2016-FY 2017)	24,982

OTP payroll subject to FICA tax in 2017 ($131,306 x .977 x .920 x .062)	7,317
OTP payroll subject to FICA tax in 2016 ($131,306 x .951 x .904 x .062)	6,999
Increase (FY 2016-FY 2017)	318
Total adjustment to base	25,300

Health insurance ($21,634) – Effective January 2015, NIST's contribution to Federal employees' health insurance premiums increased by 2.9 percent. Applied against the FY 2016 estimate of $746,000, the additional amount required is $21,634.

Employees' Compensation Fund (-$3,000) – The Employees' Compensation Fund bill for the year ending June 30, 2013, is $3,000 less than for the year ending June 30, 2012.

Communications, utilities, and miscellaneous charges	0	(114)
Electricity rate decrease	(129)	
Natural Gas rate increase	15	

The electricity ATB amount was derived using a year to year comparison of the cost per kilowatt hour. In analyzing the 12 months ended February 2015 and 2014, the per kilowatt hour rate decreased 6.0 percent (from .120 to .113) for Gaithersburg, Maryland; increased 1.0 percent (from .077 to .078) for Boulder, Colorado; and decreased 9.3 percent (from .106 to .096) for Ft. Collins, Colorado for a net decrease of $129,000.

The natural gas ATB amount was derived using a year to year comparison of the average cost per therm. In analyzing the 12 months ended February 2015 and 2014, the per therm rate remained at .456 per therm and increased 10.3 percent (from .597 to .659) for Gaithersburg and Boulder respectively resulting in a net increase of $15,000.

HMEP Center Salaries	0	697

This request funds salary and benefit inflationary cost increases for non-federal employees of the Hollings Manufacturing Extension Centers using employment cost indices provided by the Bureau of Labor Statistics (BLS) to maintain a high level of service to the public.

General pricing level adjustment	0	182

This request applies the OMB economic assumptions of 1.8 percent for FY 2017 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: communications, utilities, and miscellaneous charges $2,646; other services $167,364; supplies $6,930; and equipment $5,256.

Subtotal Other changes	(2)	977
Total Adjustments to base	(2)	977

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APPROPRIATION ACCOUNT: Industrial Technology Services (ITS)

The President's Budget request is $189.0 million for the Industrial Technology Services appropriation, which consists of two programs, the Hollings Manufacturing Extension Partnership (MEP) and the National Network for Manufacturing Innovation (NNMI) Program. The request is a $34.0 million increase from FY 2016.

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

Program: Technology innovation program
Sub-program: Technology innovation program

Line Item		2015 Actual		2016 Enacted		2017 Base		2017 Estimate		Increase/ (Decrease) Over 2017 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount
Technology innovation program	Pos./Approp	0	0	0	0	0	0	0	0	0	0
	FTE/Obl.	3	$814	1	$4,635	0	0	0	0	0	0

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Exhibit 10

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

Program: Advanced manufacturing technology consortia
Sub-program: Advanced manufacturing technology consortia

Line Item		2015 Actual Personnel	2015 Actual Amount	2016 Enacted Personnel	2016 Enacted Amount	2017 Base Personnel	2017 Base Amount	2017 Estimate Personnel	2017 Estimate Amount	Increase/ (Decrease) Over 2017 Base Personnel	Increase/ (Decrease) Over 2017 Base Amount
Advanced manufacturing technology consortia	Pos./Approp	4	$8,100	0	0	0	0	0	0	0	0
	FTE/Obl.	11	11,710	0	0	0	0	0	0	0	0

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

	FY 2015 Actual	FY 2016 Enacted	FY 2017 Estimate
Department of Defense			
Equipment Investments	$3	0	0
IE Amortization	(1)	(1)	0
Total, WCF Investments	2	(1)	0
Total, Reimbursable Program and WCF Investments	2	(1)	-

Exhibit 10

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

Program: Hollings manufacturing extension partnership
Sub-program: Hollings manufacturing extension partnership

Line Item		2015 Actual		2016 Enacted		2017 Base		2017 Estimate		Increase/ (Decrease) Over 2017 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount
Hollings manufacturing	Pos./Approp	81	$130,000	81	$130,000	81	$130,928	81	$141,991	0	$11,063
extension partnership	FTE/Obl.	66	144,556	80	151,925	80	130,928	80	141,991	0	11,063

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

	FY 2015 Actual	FY 2016 Enacted	FY 2017 Estimate
Department of Transportation	$40	0	0
Subtotal, Other Agency	40	0	0
Total, Reimbursable Program	40	-	-
Equipment Investments	22	$2	0
IE Amortization	(10)	(11)	0
Total, WCF Investments	12	(9)	0
Total, Reimbursable Program and WCF Investments	52	(9)	0

BUDGET PROGRAM: Hollings Manufacturing Extension Partnership Program (MEP)

The request includes $142.0 million for MEP, a $12.0 million increase from FY 2016. This amount includes $1.0 million for inflation increase adjustments.

BASE JUSTIFICATION:

Hollings Manufacturing Extension Partnership Program (MEP) Overview

The Hollings Manufacturing Extension Partnership Program (MEP) is a federal-state-industry partnership that provides U.S. manufacturers with access to technologies, resources, and industry experts. The MEP program consists of Manufacturing Extension Partnership Centers in every state and in Puerto Rico that work directly with the local manufacturing companies to strengthen the competitiveness of our nation's domestic manufacturing base. Funding for the MEP Centers is a cost-sharing arrangement consisting of support from the federal government, state and local government/entities, and fees charged to the manufacturing clients for services provided by the MEP Centers.

MEP's mission is to act as a strategic advisor to promote business growth and connect manufacturers to public and private resources essential for increased competitiveness and profitability. In doing so, MEP supports NIST's mission of promoting U.S. innovation and industrial competitiveness, while also advancing the goals of the U.S. Department of Commerce to maximize U.S. competitiveness and enable economic growth for U.S. industries, workers, and consumers.

A strong domestic manufacturing base is essential to supporting our nation's middle class, our national security, and our economy. To continue to foster the economic resurgence, we need strong, innovative manufacturing businesses that are expanding markets and creating good jobs. MEP is positioned to connect manufacturers with the opportunities being made available through federal and state governments to invest in environmentally sustainable manufacturing practices, develop innovative products, and diversify into new markets. MEP Centers know their communities and understand their local manufacturing industries. Across the country, they serve as trusted advisors to their manufacturing clients and help them navigate economic and business challenges, capitalize on opportunities and develop pathways leading to profitable growth.

- In FY 2017 MEP will maintain its national network, continuing to serve as a resource for manufacturing and innovation by leveraging resources to couple cost reduction strategies with profitable client company growth through new product development, technology adoption, and market expansion. MEP will continue to expand efforts to help manufacturers develop innovative practices designed to create ideas for new products, processes and services necessary to grow business opportunities. MEP will leverage the knowledge, information and connections from across the MEP system of centers and partner organizations. MEP will continue to identify areas for future investment and expansion across the MEP network to support the diverse needs of U.S. manufacturers, including workforce development, technology transfer, supplier development, and manufacturing scale-up. MEP will work to develop and deploy tools, services and training for MEP Center field staff to ensure they are equipped to help firms innovate and create new sales, enter into new markets and adopt new technologies that build competitive advantage.

- The MEP program has a strong culture of partnership. At the state and local level, MEP Centers are often closely tied to state universities, community colleges, government economic development offices, as well as workforce development organizations. MEP Centers collaborate

with third party resources and partner organizations to ensure clients receive the most effective advice and assistance. At the federal level, MEP has ongoing partnerships with several agencies including the Department of Energy, the Environmental Protection Agency, Department of Transportation, Department of Defense, the Small Business Administration and the Department of Labor. Within the Department of Commerce, MEP works closely with the International Trade Administration, the Economic Development Administration and the U.S. Patent and Trademark Office.

Examples of Accomplishments

Each year the program tracks the impact of the MEP system. The most recent data represents MEP impacts based on surveys conducted in FY 2015 including:

• New Sales	$2.3 billion
• Retained Sales	$5.7 billion
• Cost Savings	$1.2 billion
• New Client Investment	$3.2 billion
• Jobs Created	19,466
• Jobs Retained	49,011
• Manufacturers Served	29,101

The MEP network continues to use and expand partnerships and connections to work with companies to stabilize operations, diversify their customers, and create new business plans for moving towards a stronger future – saving jobs and helping firms identify new strategies for innovation and growth. The MEP continues to play an important role in efforts to strengthen U.S. manufacturing in the areas of export assistance and workforce development.

Priority Objectives for FY 2017

The broad reach and extensive manufacturing knowledge of the MEP network puts the program in the position to strategically disseminate and implement federal level initiatives and priorities throughout the country. MEP's connection to local manufacturing communities is unique and far-reaching. MEP will work to further leverage its network of Centers to focus on innovation and export opportunities for manufacturers, connect U.S. manufacturers to new technologies and commercialization opportunities, and lay the foundation for a clean energy economy that would keep jobs in the U.S., strengthen national security, and revitalize American communities. Priorities in FY 2017 include:

- Recompetition of the MEP system: MEP will complete the effort started in FY 2014 to conduct a multi-year, systematic refresh of the MEP centers. Through this process, MEP will review cooperative agreement award amounts to take into account variations in the number of target manufacturing firms in a region (as well as other factors), to ensure that Centers are adequately equipped and funded to address the needs of their manufacturing communities. The competition will increase the capacity and capability of the MEP network to support and provide services to small and medium-sized manufacturers, especially among very small firms (1-19 employees), as well as rural firms, start-ups, and support workforce development, technology acceleration and supply chain optimization.

- Technology Acceleration: MEP's strategic focus on technology acceleration through universities and federal labs enable MEP Centers to work with manufacturing firms to innovate and increase

business opportunities to address new markets, develop new products and expand services. Identifying and accelerating technology development and deployment for and with manufacturing firms is a key element of MEP's innovation strategy. Examples include:

- National Network of Manufacturing Institutes (NNMI) – MEP will continue to work with the Advanced Manufacturing National Program Office to support the Manufacturing Institutes. MEP will develop agreements with each of the individual institutes to determine how best to engage the service and expertise of the local MEP center. MEP will ensure that the resulting technologies and innovations are deployed to small manufacturers.
- Business-to-Business (B2B) Networks: MEP will focus on disseminating the results, lessons learned and best practices from the B2B projects awarded in December 2014 across the full MEP system for adoption and deployment. The B2B networks are focused on providing virtual, regional marketplaces with appropriate technology frameworks supported by face-to-face interactions. The projects will involve real-time business opportunity matching, business and technology needs, and supplier capabilities and capacities.
- Manufacturing Technology Acceleration Centers (M-TAC): MEP will continue to disseminate the results and lessons learned from the pilot M-TAC programs started in FY 2014. MEP will work to deploy these tools and techniques through the existing national network of Centers to address critical national needs in manufacturing among small and medium enterprises (SMEs) including supply chain competitiveness.

- Supply Chain: MEP will build on its efforts working with supply chains as a whole, as well as with individual manufacturers. By doing so, MEP assistance results in high-performing supply chains that collaborate through multiple tiers, creating the capability to develop, manufacture, and distribute new or improved products more rapidly.

- Workforce: MEP will continue to support efforts to accelerate the development of industry-led skills strategies that result in a productive workforce for employers and high-quality jobs for workers. MEP helps manufacturers address their challenges at multiple levels, through better education and training of modern production workers, promoting organizational policies that reflect progressive workforce and business practices, and assisting in cost reduction and sales growth to avert layoffs.

- Export: MEP will support the export goals outlined in the National Export Initiative (NEI)/NEXT through partnerships with the International Trade Administration and other organizations focused on helping manufacturers identify opportunities and overcome the challenges to expanding into overseas markets.

- Partnerships: MEP will continue to identify partnership opportunities, at all levels of government, to leverage the federal investment in support of the tools, services, and information needed by the manufacturing industry. Through these partnerships, MEP will continue to support the "Make it in America" activities by identifying manufacturers with current or future capabilities to address the procurement opportunities of the federal government and original equipment manufacturers.

The MEP network has proved, through client reported impact metrics and long-standing federal, state, and local partnerships, to be a valuable resource to America's manufacturers. As investments are being made in workforce, technology innovation, and export programs initiatives, MEP will ensure that these initiatives reach the targeted manufacturing community and that firms are connected with the opportunities at the federal and state level.

PROGRAM CHANGE(S):

1. MEP Programmatic Increase (Base Funding: $130.9 million and 80 FTE; Program Change: + $11.1 million and + 0 FTE).

NIST requests an increase of $11.1 million and 0 FTE.

A strong manufacturing base is critical to the financial and national security of the U.S. and to the maintenance of the world leading innovation ecosystem. Manufacturers are facing new and significant challenges. Technology and globalization have fundamentally changed many manufacturing companies and products. Manufacturing increasingly depends on access to customers and the infrastructure needed to support the constant reinvention of the manufacturers' products and processes. The challenge is clear: increasing global competition, coupled with the changing nature of innovation and exacerbated by the economic downturn of late, demands that the U.S. proactively support its domestic manufacturing base through the development, acceleration, and deployment of manufacturing technologies.

Sustaining and strengthening the U.S. manufacturing industry requires an efficient federal role, partnering with state and local governments, to supply high-quality unbiased information, advice, and assistance that help firms respond to new challenges. For over 25 years, MEP has successfully provided services that reduce manufacturers' bottom-line expenses, increase efficiencies, build capacity, develop new products, and attract new customers, both domestic and global. Through strategies built upon expert competencies, the MEP program works to provide services to support the diverse needs of the U.S. manufacturing industry.

Proposed Actions

NIST MEP's plan for increased capabilities to be able to assist all growth oriented SMEs respond to critical national needs is based upon adherence to a comprehensive strategic plan, a focus on operational excellence, system-wide recompetition through a formal, multi-year, organizational competition, and progressive growth in funding to serve all innovative manufacturing firms.

The additional $11.1 million will be used in FY 2017 to complete the final round of the multi-year competition of the MEP centers, and maintain the funding of states previously competed, and provide funding for additional performance-based awards to high perfoming centers. Out of the $142.0 million in total MEP funding, a minimum of $121.0 million would be direct funding to the MEP centers. With the increased funding, the program will allocate funds across the network to reduce the variation in funding across the system and will allow the program to target additional resrouces strategically for key performance objectives including improved data collection and dissemination. The increase in funding for MEP centers would allow them to work with more very small, rural and start-up firms and would significantly improve market penetration with manufacturers with 1-19 employees. (see Table 1)

The programmatic output of this funding level on small manufacturing firms will result in a transformational impact on the nation's small manufacturing firms and the nation's economic competitiveness. The increased funding level will:

- Increase the number of clients receiving MEP services by over 40 percent over the next three years with a particular emphasis on working with more small manufacturers. In particular, MEP will increase the number of small manufacturers it serves over the next three years by about 75 percent. (See Table 1)

- Generate additional economic impacts as a result of this increased investment. The increased investment will result in an additional $800.0 million in new and retained sales, $352.0 million in new investment, $120.0 million in cost savings, and nearly 7 thousand new and retained jobs. (See Table 2)

Table 1: Current & Future Market Penetration

Employment Size Category	Current 3 Year Market Penetration	Future 3 Year Market Penetration @$142M ($121M to centers)	% Change in Market Penetration
1-19 employees	5,511	9,680	75.6%
20-49 employees	3,377	4,140	22.6%
50-99 employees	2,343	2,870	22.5%
100-249 employees	2,433	3,160	29.9%
250-499 employees	902	1,040	15.3%
>=500 employees	537	537	0.0%
Total	15,103	21,427	41.9%

Table 2: Change in Anticipated Client Impacts

Impact Category	Current Impacts	Future Impacts @$135M	% change in Impacts
Total Sales	$8.0 billion	$8.8 billion	10.0%
New Investment	$3.2 billion	$3.552 billion	10.0%
Cost Savings	$1.2 billion	$1.32 billion	10.0%
New & Retained Jobs	68,477 jobs	75,325 jobs	10.0%

Statement of Need and Economic Benefits

The increased funding enables the flexibility to develop and provide innovative services and technologies, and the funding to reach a critical mass of SMEs.

The proposed budget increase will enable MEP to execute the follow strategic objectives identified in the Department of Commerce's Strategic Plan:

- Accelerate advanced manufacturing
- Catalyze innovation ecosystems

In addition, MEP's successfully proven ExporTech Program, in a partnership with ITA, advances the Trade and Investment Strategic Objective of increasing U.S. exports by broadening and deepening the U.S. exporter base.

The funding increase will also allow the MEP system to play a robust role in transferring to the small manufacturing sector the results of the R&D activities of the new Manufacturing Innovation Institutes, whose establishment is a priority for the nation, the Congress, and NIST. MEP is identified in the proposed authorizing legislation as the vehicle for SME engagement; however, the mission-driven agency funded NNMI model of the first 8 institutes does not explicitly provide resources for a nation-wide mechanism for SME engagement. MEP's deep experience in technology transition and acceleration, its nationwide network, now informed by the M-TAC pilot program, enhances this capability. Additional funding will enable the Centers to execute the full mission of the NNMI program.

The MEP program is also explicitly identified in the 2014 recommendations of the Advanced Manufacturing Partnership (AMP 2.0), particularly by the work stream priorities in manufacturing scale up, supply chain optimization, and manufacturing image (which embraces MEP's nationally recognized annual Manufacturing Day).

MEP's mission and priorities outlined in its strategic plan (http://www.nist.gov/mep/about/strategic-plan.cfm) support the Department's strategic objectives, and works to enhance the competitiveness of U.S. manufacturing by fostering innovation and promoting the development of new products and technologies by U.S. manufacturers.

This investment supports a robust MEP system that is positioned to:

- Provide additional manufacturers with the tools and services needed to respond to the rapid global change of technology and business systems advances to create new opportunities to grow their company;
- Respond to manufacturers' workforce challenges;
- Accelerate the adoption of technologies by manufacturers and speed up the diffusion of new technologies into commercialized products;
- Improve manufacturers' competitive advantage through reduced environmental costs and impact;
- Help manufacturers build strong, stable businesses that provide good, middle class jobs; and,
- Foster innovative partnerships with industry, academia, and local, state, and federal governments that are focused on meeting the increased challenges facing U.S. manufacturers.

Performance Goals and Measurement Data:

Note: The targets listed below are only rough estimates for the incremental funding received. These represent new measures for MEP.

Performance Goal Performance Measure: Number of firms receiving in-depth technical assistance from MEP Centers	FY 2017 Target	FY 2018 Target	FY 2019 Target	FY 2020 Target	FY 2021 Target
With increase	10,580	11,640	12,800	14,100	15,500
Without increase	9,200	9,200	9,200	9,200	9,200

Performance Goal Performance Measure: Percentage of MEP clients receiving in-depth technical assistance that increase their competitiveness	FY 2017 Target	FY 2018 Target	FY 2019 Target	FY 2020 Target	FY 2021 Target
With increase	65%	66%	67%	69%	71%
Without increase	64%	64%	64%	64%	64%

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Program: Hollings Manufacturing Extension Partnership Program
Subprogram: Hollings Manufacturing Extension Partnership Program
Program Change: Hollings Manufacturing Extension Partnership Program

	Object Class	FY 2017 Increase	FY 2017 Total Program
11	Personnel compensation		
11.1	Full-time permanent	0	$8,417
11.3	Other than full-time permanent	0	664
11.5	Other personnel compensation	0	142
11.8	Special personnel services payments	0	0
11.9	Total personnel compensation	0	9,223
12	Civilian personnel benefits	0	2,988
13	Benefits for former personnel	0	0
21	Travel and transportation of persons	$2	502
22	Transportation of things	0	7
23.1	Rental payments to GSA	0	4
23.2	Rental Payments to others	0	0
23.3	Communications, utilities and miscellaneous charges	88	1,190
24	Printing and reproduction	0	6
25.1	Advisory and assistance services	0	1,354
25.2	Other services	43	5,534
25.3	Purchases of goods & services from Gov't accounts	8	519
25.4	Operation and maintenance of facilities	0	0
25.5	Research and development contracts	0	0
25.6	Medical care	0	0
25.7	Operation and maintenance of equipment	8	254
25.8	Subsistence and support of persons	0	0
26	Supplies and materials	10	318
31	Equipment	4	270
41	Grants, subsidies and contributions	10,900	119,822
44	Refunds	0	0
99	Total obligations	11,063	141,991

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

Program: National network for manufacturing innovation
Sub-program: National network for manufacturing innovation

Line Item		2015 Actual		2016 Enacted		2017 Base		2017 Estimate		Increase/ (Decrease) Over 2017 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount
National network for	Pos./Approp	0	0	16	$25,000	16	$25,049 [2/]	18	$47,000	2	$21,951
manufacturing innovation	FTE/Obl.	0	0	16	28,277 [1/]	15	25,049	16	47,000 [1/]	1	21,951

[1/] The NNMI obligation amount of $28,277K includes $3,277K of AMTech carryover.
[2/] The FY 2017 base amount was adjusted for the FY 2017 share of ATBs ($49K).

BUDGET PROGRAM: National Network for Manufacturing Innovation (NNMI) Program

The request provides funds for federal investment in the National Network for Manufacturing Innovation Program, which serves to create an effective manufacturing research infrastructure for U.S. industry and academia to solve industry-relevant problems. The NNMI consists of linked Institutes for Manufacturing Innovation with common goals, but unique concentrations. In an institute, industry, academia, and government partners leverage existing resources, collaborate, and co-invest to nurture manufacturing innovation and accelerate commercialization. As sustainable manufacturing innovation hubs, the institutes will create, showcase, and deploy new capabilities, new products, and new processes that can impact commercial production. They will build workforce skills at all levels and enhance manufacturing capabilities in companies large and small. Institutes will draw together the best talents and capabilities from all the partners to build the proving grounds where innovations flourish and to help advance American domestic manufacturing. The request includes $47.0 million in discretionary funds for the program, for institute creation and support on topics proposed by industry, and for efficient coordination among all institutes stood up by Commerce and other agencies.

BASE JUSTIFICATION

This budget program was first appropriated funds in FY 2016, pursuant to the Revitalize American Manufacturing and Innovation (RAMI) Act of 2014. The FY 2016 enacted bill provided $25.0 million in discretionary funds. This program and funding is part of government-wide efforts to strengthen the U.S. advanced manufacturing sector.

As part of its efforts to revitalize U.S. manufacturing, NIST proposed and Congress authorized (RAMI) a National Network for Manufacturing Innovation (NNMI), which would consist of a network of manufacturing innovation institutes where researchers, companies, universities, community colleges, and entrepreneurs can come together to develop new manufacturing technologies with broad applications, as well as train the workforce needed to work in advanced manufacturing industries. The primary goal is to ensure that American innovations and inventions, currently going off-shore for production in competitor nations, would be scaled up from the lab-scale experiments to industrial scale by developing new manufacturing processes to be used by entire industry sectors.

Each institute in the NNMI has a unique technology focus with the objective of creating self-sustaining regional manufacturing hubs that have national impact. The institutes help support an ecosystem of manufacturing activity in regions of the U.S. The manufacturing innovation institutes support manufacturing technology commercialization by helping to bridge the gap from the laboratory to the market and address core gaps in scaling manufacturing process technologies.

PROGRAM CHANGE(S):

National Network for Manufacturing Innovation (NNMI) (Base Funding: $25.0 million and 15 FTE; +$22.0 million and +1 FTE)

The FY 2017 President's Budget request includes a $22.0 million and 1 FTE increase for the program, for a total of $47.0 million, to fund and maintain three institutes for up to seven years. Funds are also provided within the totals for NIST to coordinate network activities of all institutes in the NNMI. The funding increase is needed to ultimately reach the government-wide vision of a network of up to 45 institutes for the NNMI.

The FY 2017 President's Budget request also proposes a mandatory appropriations account beginning in FY 2018.

The budget proposes $1.890 billion in one-time mandatory appropriations in FY 2017 for this program to be executed from FY 2018 to FY 2025 to complete the network. The NNMI mandatory section of this budget document further describes efforts that will be undertaken for the $1.890 billion in mandatory funds requested in FY 2017.

PROGRAM CHANGE PERSONNEL DETAIL

Program: National Network for Manufacturing Innovation (NNMI)
Subprogram: National Network for Manufacturing Innovation (NNMI)
Program Change: National Network for Manufacturing Innovation (NNMI)

Title:	Grade	Number of Positions	Annual Salary	Total Salaries
Project Managers	ZP V	1	$127,886	$127,886
Engineer/Scientist	ZA V	1	127,886	127,886
Total		2		255,772
Less Lapse	25%	(1)		(63,943)
Total full-time permanent (FTE)		1		191,829
2017 Pay Adjustment (1.6%)				3,069
Total				194,898

Personnel Data	Number
Full-Time Equivalent Employment	
Full-time permanent	1
Other than full-time permanent	0
Total	1
Authorized Positions:	
Full-time permanent	2
Other than full-time permanent	0
Total	2

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Program: National Network for Manufacturing Innovation (NNMI)
Subprogram: National Network for Manufacturing Innovation (NNMI)
Program Change: National Network for Manufacturing Innovation (NNMI)

	Object Class	FY 2017 Increase	FY 2017 Total Program
11	Personnel compensation		
11.1	Full-time permanent	$195	$1,914
11.3	Other than full-time permanent	0	0
11.5	Other personnel compensation	0	0
11.8	Special personnel services payments	0	0
11.9	Total personnel compensation	195	1,914
12	Civilian personnel benefits	64	642
13	Benefits for former personnel	0	0
21	Travel and transportation of persons	3	142
22	Transportation of things	0	1
23.1	Rental payments to GSA	0	0
23.2	Rental Payments to others	0	0
23.3	Communications, utilities and miscellaneous charges	0	723
24	Printing and reproduction	2	4
25.1	Advisory and assistance services	0	0
25.2	Other services	474	1,915
25.3	Purchases of goods & services from Gov't accounts	0	64
25.4	Operation and maintenance of facilities	0	0
25.5	Research and development contracts	0	0
25.6	Medical care	0	0
25.7	Operation and maintenance of equipment	0	67
25.8	Subsistence and support of persons	0	0
26	Supplies and materials	0	84
31	Equipment	3	34
41	Grants, subsidies and contributions	21,210	41,410
44	Refunds	0	0
99	Total obligations	21,951	47,000

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Exhibit 10

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

Program: Baldrige performance excellence program
Sub-program: Baldrige performance excellence program

Line Item		2015 Actual		2016 Enacted		2017 Base		2017 Estimate		Increase/ (Decrease) Over 2017 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount
Baldrige performance	Pos./Approp	0	0	0	0	0	0	0	0	0	0
excellence program	FTE/Obl.	0	0	0	$63	0	0	0	0	0	0

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

	FY 2015 Actual	FY 2016 Enacted	FY 2017 Estimate
Technical & Advisory Services	$80	$80	$90
Subtotal, Other Reimbursables	80	80	90
Total, Reimbursable Program	80	80	90
Total, Reimbursable Program and WCF Investments	80	80	90

Exhibit 16

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

	Object Class	2015 Actual	2016 Enacted	2017 Base	2017 Estimate	Increase/ (Decrease) Over 2017 Base
11	Personnel compensation					
11.1	Full-time permanent	$7,967	$10,150	$10,136	$10,331	$195
11.3	Other than full-time permanent	988	1,124	664	664	0
11.5	Other personnel compensation	163	142	142	142	0
11.9	Total personnel compensation	9,118	11,416	10,942	11,137	195
12.1	Civilian personnel benefits	2,803	3,714	3,566	3,630	64
13	Benefits for former personnel	0	0	0	0	0
21	Travel and transportation of persons	540	644	639	644	5
22	Transportation of things	11	9	8	8	0
23.1	Rental payments to GSA	3	4	4	4	0
23.2	Rental payments to others	0	0	0	0	0
23.3	Communications, utilities, and miscellaneous charges	921	2,045	1,825	1,913	88
24	Printing and reproduction	10	13	8	10	2
25.1	Advisory and assistance services	52	1,922	1,354	1,354	0
25.2	Other services	6,168	13,232	6,932	7,449	517
25.3	Purchases of goods and services from government accounts	1,589	582	575	583	8
25.5	Research and development contracts	0	0	0	0	0
25.7	Operation and maintenance of equipment	314	316	313	321	8
26	Supplies and materials	446	524	392	402	10
31	Equipment	367	306	297	304	7
32	Land and structures	0	0	0	0	0
41	Grants, subsidies, and contributions	134,737	150,173	129,122	161,232	32,110
42	Insurance claims and indemnities	0	0	0	0	0
43	Interest and dividends	1	0	0	0	0
99	Total Obligations	157,080	184,900 [1/]	155,977 [2/]	188,991	33,014

	Object Class	2015 Actual	2016 Enacted	2017 Base	2017 Estimate	Increase/ (Decrease) Over 2017 Base
99	Total Obligations	$157,080	$184,900	$155,977	$188,991	$33,014
	Less Prior Year Recoveries	(5,974)	(8,500)	0	0	0
	Less Prior Year Refunds	(911)	0	0	0	0
	Less Prior Year Unobligated Balance	(33,495)	(21,400)	0	0	0
	Plus Unobligated Balance End of Year	21,400	0	0	0	0
	Total Budget Authority/Appropriation	138,100	155,000	155,977	188,991	33,014
	Personnel Data					
	Full-time equivalent employment:					
	Full-time permanent	72	90	89	90	1
	Other than full-time permanent	8	7	6	6	0
	Total	80	97	95	96	1
	Authorized Positions:					
	Full-time permanent	80	91	91	93	2
	Other than full-time permanent	5	6	6	6	0
	Total	85	97	97	99	2

[1/] The NNMI obligation amount of $28,277K includes $3,277K of AMTech carryover.

[2/] The FY 2017 NNMI base amount was adjusted for the FY 2017 share of ATBs ($49K).

Department of Commerce
National Institute of Standards and Technology
Industrial Technology Services
SUMMARY OF INFORMATION TECHNOLOGY RESOURCES
(Dollar Amounts in thousands)

IT Projects by Activity/Subactivity: (Totals by Activity)	Unique Investment Identifier	IT Investment Title	2015 Actual	2016 Enacted	2017 Estimate	Increase/ Decrease
Hollings Manufacturing Extension Partnership (MEP)						
	006-000705000	MEP Systems	$1,735	$1,777	$1,821	$44
Total			1,735	1,777	1,821	44

Department of Commerce
National Institute of Standards and Technology
Industrial Technology Services
APPROPRIATION LANGUAGE AND CODE CITATIONS

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

15 U.S.C. 271 et seq.
15 U.S.C. 272(b)(1) and (b)(4)
15 U.S.C. 278b
15 U.S.C. 278k
15 U.S.C. 278l
15 U.S.C. 278n
15 U.S.C. 278r
15 U.S.C. 7506(a)(2)

15 U.S.C. 271 et seq. provides NIST's organic authorities.

15 U.S.C. 272(b)(1) authorizes the Secretary, through the Director of NIST, to assist industry in the development of technology and procedures needed to improve quality, to modernize manufacturing processes, to ensure product reliability, manufacturability, functionality, and cost-effectiveness, and to facilitate more rapid commercialization, especially by small- and medium-sized companies throughout the United States, of products based on new scientific discoveries in fields such as automation, electronics, advanced materials, biotechnology, and optical technologies.

15 U.S.C. 272(b)(4) authorizes the Secretary, through the Director of NIST, to enter into contracts, including cooperative research and development arrangements and grants and cooperative agreements, in furtherance of the purposes of the NIST Act.

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 established 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. Public Law 110-69 signed on August 9, 2007 has now abolished the Advanced Technology Program (ATP).

15 U.S.C. 7506(a)(2) instructs the NIST Director to utilize the Manufacturing Extension Partnership program to the extent possible to ensure that basic research on issues related to the development and manufacture of nanotechnology, including metrology; reliability and quality assurance; processes control; and manufacturing best practices reaches small- and medium-sized manufacturing companies.

2. $141,991,000 is provided for the Hollings Manufacturing Extension Partnership to remain available until expended.

$47,000,000 is provided for the National Network for Manufacturing Innovation Program NNMI to remain available until expended.

3. Public Law 110-69, America Competes Act, 121 Stat 572, enacted August 9, 2007 reauthorized the Industrial Technology Services appropriation through 2010. In addition, it eliminated the Advanced Technology Program (ATP) and established the Technology Innovation Program (TIP) which provides grants to eligible companies or joint ventures whose proposed technology has strong potential to address critical national needs. It also amended 15 U.S.C. 3711 by changing the name of the National Medal of Technology from "Technology Medal" to "Technology and Innovation Medal".

4. Public Law 111-358, America Competes Reauthorization Act, 2010, 124 Stat 3982, enacted January 4, 2011 reauthorized the Industrial Technology Services appropriation through 2013 to include the Manufacturing Extension Partnership Program (MEP) and the Malcolm Baldrige National Quality Award program. In addition, authorization is provided for an Innovative Services Initiative to assist small and medium-sized manufacturers within the MEP program.

5. Public Law 112-55, Consolidated and Further Continuing Appropriations Act, 2012, 125 Stat 552, enacted November 18, 2011 did not contain funding for the Technology Innovation Program (TIP) and the Baldrige Performance Excellence Program (BPEP).

6. Public Law 113-235, Consolidated and Further Continuing Appropriations Act, 2015, 128 Stat 2130, enacted December 16, 2014 amends 15 U.S.C. 271 et seq by establishing the Network for Manufacturing Innovation Program within the Industrial Technology Services appropriation to facilitate access to capital-intensive infrastructure in order to transition innovative technologies into scalable, cost-effective, and high-performing manufacturing capabilities thereby stimulating U.S. leadership in advanced manufacturing research, innovation, and technology. As part of the program, the Secretary shall establish a network of centers for manufacturing innovation. Funding for the program is as follows: "to the extent provided for in advance by appropriations Acts the Secretary may use not to exceed $5,000,000 for each of the fiscal years 2015 through 2024 to carry out this section from amounts appropriated to the Institute for Industrial Technical Services" and, "to the extent provided for in advance by appropriations Acts, the Secretary of Energy may transfer to the Institute not to exceed $250,000,000 for the period encompassing fiscal years 2015 through 2024 from amounts appropriated for advanced manufacturing research and development within the Energy Efficiency and Renewable Energy account for the Department of Energy."

7. Public Law 114-113, Consolidated Appropriations Act, 2016, enacted on December 18, 2015 did not contain funding for the Advanced Manufacturing Technology Consortia. The accompanying Explanatory Statement contained language which moved the program into the National Network for Manufacturing Innovation as follows: "The agreement also merges the activities of the Advanced Manufacturing Technology Consortia (AMTech) into NNMI (National Network for Manufacturing Innovation)."

Exhibit 34

Department of Commerce
National Institute of Standards and Technology
Industrial Technology Services
ADVISORY AND ASSISTANCE SERVICES
(Obligations in thousands of dollars)

	FY 2015 Actual	FY 2016 Estimate	FY 2017 Estimate
Management and professional support services	$49	$1,922	$1,354
Studies, analyses, and evaluations	3	0	0
Engineering and technical services	0	0	0
Total	52	1,922	1,354

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 the Hollings MEP Program.

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.

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Construction of
Research Facilities

Exhibit 5

Department of Commerce
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
2016 Enacted	120	120	$119,000	$143,827	$119,000
less: Unobligated balance from prior year	0	0	0	(24,827)	0
2017 Adjustments to base:					
plus: Inflationary cost changes	0	0	746	746	746
2017 Base Request/Estimate	120	120	119,746	119,746	119,746
plus: 2017 Program changes	0	0	(24,751)	(24,751)	(24,751)
2017 Estimate	120	120	94,995	94,995	94,995

		2015 Actual		2016 Enacted		2017 Base		2017 Estimate		Increase/ (Decrease) Over 2017 Base	
Comparison by program/sub-program:		Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount
Construction and major renovations											
Construction and major	Pos/Approp	87	$50,300	120	$119,000	120	$119,746	120	$94,995	0	(24,751)
renovations	FTE/Obl.	83	$39,706	120	143,827	120	119,746	120	94,995	0	(24,751)
Adjustments for:											
Prior year recoveries			(2,218)		0		0		0		0
Unobligated balance, start of year			(12,015)		(24,827)		0		0		0
Unobligated balance, end of year			24,827		0		0		0		0
Financing from transfers:											
Transfers to other accounts (+)			0		0		0		0		0
Appropriation			50,300		119,000		119,746		94,995		(24,751)

Exhibit 6

Department of Commerce
National Institute of Standards and Technology
Construction of Research Facilities
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Comparison by program/sub-program:		2015 Actual		2016 Enacted		2017 Base		2017 Estimate		Increase/ (Decrease) Over 2017 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount
Construction and major renovations											
Safety, Capacity, Maintenance and	Pos./BA	0	0	0	0	0	0	0	0	0	0
Major Repairs	FTE/Obl.	0	$892	0	$919	0	0	0	0	0	0

Exhibit 7

Department of Commerce
National Institute of Standards and Technology
Construction of Research Facilities
SUMMARY OF FINANCING
(Dollar amounts in thousands)

	2015 Actual	2016 Enacted	2017 Base	2017 Estimate	Increase/ (Decrease) Over 2017 Base
Total Obligations	$40,598	$144,746	$119,746	$94,995	(24,751)
Financing:					
Offsetting collections from:					
Federal funds	0	0	0	0	0
Non-Federal sources	(919)	0	0	0	0
Total offsetting collections	(919)	0	0	0	0
Adjustments for:					
Prior year recoveries (Direct)	(2,218)	0	0	0	0
Unobligated balance, start of year (Direct)	(12,015)	(24,827)	0	0	0
Unobligated balance, start of year (Reimbursable)	(892)	(919)	0	0	0
Unobligated balance, end of year (Direct)	24,827	0	0	0	0
Unobligated balance, end of year (Reimbursable)	919	0	0	0	0
Budget Authority	50,300	119,000	119,746	94,995	(24,751)
Financing:					
Transfer to other accounts	0	0	0	0	0
Transfer from other accounts	0	0	0	0	0
Appropriation	50,300	119,000	119,746	94,995	(24,751)

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Department of Commerce
National Institute of Standards and Technology
Construction of Research Facilities
JUSTIFICATION OF ADJUSTMENTS TO BASE
(Dollar amounts in thousands)

	FTE	Amount
Other Changes:		
Annualization of 2016 pay raise	0	27

A pay raise of 1.3 percent is assumed to be effective January 1, 2016.

Total cost in FY 2017 of 2016 pay raise	$ 109,333
Less amount requested in FY 2016	(82,000)
Less amount absorbed in FY 2016	0
Amount requested in 2017 to provide full-year cost of 2016 pay raise	27,333

2017 Pay increase and related costs	0	163

A general pay raise of 1.6 percent is assumed to be effective January 1, 2017.

Total cost in FY 2017 of pay increase	$ 163,000
Less amount absorbed in FY 2017	
Amount requested for FY 2017 pay increase	163,000
Payment to Departmental Management Working Capital Fund	0
Total adjustment for FY 2017 pay increase	163,000

Change in compensable days	0	(102)

The decreased cost of one less compensable day in FY 2017 compared to FY 2016 is calculated by dividing the FY 2016 estimated personnel compensation ($10,803,000) and applicable benefits ($2,619,000) by 262 compensable days. The cost decrease of two less compensable days is $102,458.

Personnel benefits	0	132

Civil Service Retirement System (CSRS)	($20)
Federal Employees' Retirement System (FERS)	90
Thrift Savings Plan (TSP)	14
Federal Insurance Contribution Act (FICA) - OASDI	27
Health Insurance	23
Employees Compensation Fund	(2)

Civil Service Retirement System (-$20,000) – 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 4.9 percent in FY 2016 to 2.3 percent in FY 2017. The contribution rate will remain at 7.0 percent in FY 2017.

Payroll subject to retirement systems ($10,792,197)	
Cost of CSRS contributions in FY 2017 ($10,792,197 x .023 x .07)	$ 17,375
Cost of CSRS contributions in FY 2016 ($10,792,197 x .049 x .07)	37,017
Total adjustment to base	(19,642)

Federal Employees' Retirement System ($90,000) – 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 95.1 percent in FY 2016 to 97.7 percent FY 2017.

Payroll subject to retirement systems ($10,792,197)	
Basic benefit cost in FY 2017 ($10,792,197 x .977 x .137)	$1,444,525
Basic benefit cost in FY 2016 ($10,792,197 x .951 x .132)	1,354,766
Total adjustment to base	89,759

Thrift Savings Plan ($14,000) – The cost of agency contributions to the Thrift Savings Plan will also rise as FERS participation increases. The contribution rate increased from 4.62 percent in FY 2016 to 4.63 percent in FY 2017.

Thrift plan cost in FY 2017 ($10,792,197 x .977 x .0463)	$ 488,186
Thrift plan cost in FY 2016 ($10,792,197 x .951 x .0462)	474,168
Total adjustment to base	14,018

Federal Insurance Contributions Act (FICA) - OASDI ($27,000) – As the percentage of payroll covered by FERS increases, the cost of OASDI contributions will increase. In FY 2016, the maximum salary subject to OASDI tax was $119,100 and will increase to $126,200 in FY 2017. The OASDI tax rate for employers will remain at 6.2 percent in FY 2017.

FERS payroll subject to FICA tax in 2017 ($10,792,197 x .977 x .920 x .062)	$ 601,428
FERS payroll subject to FICA tax in 2016 ($10,792,197 x .951 x .904 x .062)	575,242
Increase (FY 2016-FY 2017)	26,186
OTP payroll subject to FICA tax in FY 2017 ($302,803 x .977 x .920 x .062)	16,875
OTP payroll subject to FICA tax in FY 2016 ($302,803 x .951 x .904 x .062)	16,140
Increase (FY 2016-FY 2017)	735
Total adjustment to base	26,921

Health insurance ($23,000) – Effective January 2014 NIST's contribution to Federal employees' health insurance premiums increased by 2.9 percent. Applied against the FY 2016 estimate of $797,000, the additional amount required is $23,000.

Employees' Compensation Fund (-$2,000) – The Employees' Compensation Fund bill for the year ending June 30, 2013, is $2,000 less than for the year ending June 30, 2012.

General pricing level adjustment	0	526

This request applies the OMB economic assumptions of 1.8 percent for FY 2017 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: other services $499,464; supplies and materials $24,426; and equipment $2,754.

Subtotal, Other changes	0	746
Total Adjustments to base	0	746

Department of Commerce
National Institute of Standards and Technology
Construction of Research Facilities
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Program: Construction and major renovations
Sub-program: Construction and major renovations

Line Item		2015 Actual		2016 Enacted		2017 Base		2017 Estimate		(Increase/ Decrease) Over 2017 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount
Construction and major renovations	Pos/Approp	6	0	0	60,000	0	60,000	0	40,000	0	(20,000)
	FTE/Obl.	5	$3,090	0	64,561	0	60,000	0	40,000	0	(20,000)
Safety, Capacity, Maintenance and Major Repairs	Pos/Approp	80	50,300	120	$59,000	120	$59,746	120	$54,995	0	(4,751)
	FTE/Obl.	77	36,491	120	77,205	120	59,746	120	54,995	0	(4,751)
External Projects	Pos/Approp	1	0	0	0	0	0	0	0	0	0
	FTE/Obl.	1	125	0	2,061	0	0	0	0	0	0
Total	Pos/Approp	87	50,300	120	119,000	120	119,746	120	94,995	0	(24,751)
	FTE/Obl.	83	39,706	120	143,827	120	119,746	120	94,995	0	(24,751)

APPROPRIATION ACCOUNT: CONSTRUCTION OF RESEARCH FACILITIES (CRF)
BUDGET PROGRAM: CONSTRUCTION AND MAJOR RENOVATIONS

For FY 2017, NIST requests a total of $95.0 million and 120 FTE for Construction and Major Renovations.

BASE JUSTIFICATION:

CRF Overview

The NIST Safety, Capacity, Maintenance, and Major Repairs (SCMMR) program funds all NIST construction activities, including maintenance, repair, improvements, and major renovation of facilities occupied or used by NIST in Gaithersburg, Maryland; Boulder and Fort Collins, Colorado; and Kauai, Hawaii to meet current and future measurement and research needs for the nation.

In the 1950s and 1960s, the U.S. recognized its need to invest in science and technology. More than half a century later, the aging and deteriorating buildings and infrastructure threaten NIST's ability to meet its 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." While some improvements have been made, the current state of facilities remains a serious impediment to NIST's ability to conduct measurement research.

Without proper and reliable facilities and infrastructure, the work and research being conducted at NIST and relied upon, not just by the U.S. but also globally, is at risk of failure. NIST plays a critical role at the apex of calibrations, radioactivity and dose measurements, and neutron dosimetry for many U.S. industries. For example NIST directly supports: 38.9 million annual mammography procedures; 81.2 million computed tomography scan procedures; a $2.0 billion brachytherapy (cancer radiation therapy) market; a $152.3 million global radiation detection, monitoring and safety market with a U.S. market share of 40 percent; irradiation of 120,000 tons of food annually; and development of 276 radioactivity standard reference materials. The work conducted at NIST has critical impact on multiple sectors of the economy and directly affects consumer safety with food irradiation; worker safety with radiation protection; environmental health with environmental monitoring; public safety through homeland security applications, and public health through medical applications. Some examples of technologies relying on traceability to NIST include: mammography; external radiation beam therapies (cancer treatment); internal radiation therapies; positron emission tomography/computed tomography scans; dental and medical x-rays; medical fluoroscopy; cardio stress tests; metabolic studies (gallbladder, kidney, intestines); and medical device sterilization.

NIST research is also critical to advances in vital fields such as nanotechnology, semiconductor technology, bioscience, and many other high impact areas. Deterioration of NIST buildings and infrastructure makes the mission harder to achieve. For example, poor vibration control, poor temperature control, and low air quality due to 50-year old air conditioning and heating systems jeopardize research and even the most basic measurement calibrations.

Examples of critical facility and infrastructure investments to support the needs of this modern research institution include:

- Replace aging, obsolete, failed mechanical systems, to include heating and cooling coils, chillers, condenser units, exhaust fans, condensate receivers, vacuum pumps, steam traps;
- Upgrade heating, ventilation, and air conditioning control systems from 1960's pneumatic to current-day direct digital to address building supply/return/exhaust air rebalancing issues;
- Replace roofs;
- Refurbish elevators;
- Replace motor control centers, transformers, switchgear, network protectors, buss ducts, panels, UPS systems, fire alarm systems, variable frequency drives;
- Address building envelope exterior and interior architectural systems' degradations – energy inefficient and/or leaking windows and doors, rollup doors, below grade water infiltration through foundation cracks, and worn out ceilings and flooring;
- Address leaks and deterioration of underground potable water, sewer, electrical feeder, and compressed air systems;
- Abate asbestos; and,
- Repair deteriorating road, parking lot, and sidewalk surfaces.

State-of-the-art facilities are essential to the capabilities of NIST laboratories. NIST measurement capabilities must be maintained at the highest levels of precision and accuracy to meet the increasingly stringent needs of their users. Also, facilities must be compliant with various health and safety regulations. Other major considerations for facilities are to increase the capacity of facilities, to improve access for people with disabilities, and to safeguard the utility infrastructure of existing buildings.

NIST prioritizes its efforts to improve and upgrade its facilities to address its highest priority SCMMR projects. If major facilities-related emergency situations arise, previously planned facilities work is reprioritized as appropriate.

SUB-PROGRAM: SCMMR

Example objectives of the SCMMR sub-program are to:

- Continue the repair and upgrade of facilities that have a high impact on staff and visitor safety;
- Continue abatement of hazardous materials from site buildings and structures;
- Continue facilities modifications 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 fire safety systems that are failing at an accelerated rate because they are over 40 to 50 years old;
- Continue site infrastructure upgrades and repairs, to include roads, loading docks, pedestrian walk areas, and storm water drainage;
- Enable or maintain building environmental conditions required for meeting scientific requirements;
- Continue to reduce the backlog of deferred maintenance projects including major renovation projects; and,
- Intensify targeted energy conservation, water efficiency, and building system upgrades to facilitate meeting sustainability requirements stipulated in Executive Order 13693.

SUB-PROGRAM: Construction and Major Renovations

Base funds of $40.0 million will continue the multi-year effort to renovate and modernize the Radiation Physics Building 245. The FY 2017 funding will allow NIST to begin the next phase of a multi-phased project for the Building 245 Modernization (B245M), specifically the construction of a D Wing addition, excavation and waterproofing of existing subterranean laboratory spaces in the B, C, and D Wings, and to begin the replacement of the failing B, C, and D Wing environmental and mechanical systems. This funding will allow the continued migration of research requiring strict environmental tolerances (temperature, humidity and air filtration) from antiquated space to modern facilities. This phase will incorporate the addition of approximately 9,000 gross square feet (gsf) of modern laboratory space and approximately 9,000 gsf of new consolidated mechanical/infrastructure support space with new mechanical equipment as well as controls to provide the much needed tighter environmental controls. This funding also incorporates the correction of a portion of the chronic water infiltration problem in the basement and sub-basement laboratories.

Multi-Year Budget Information ($ in thousands)

Major Cost Categories	FY 2015 and Prior	FY 2016	FY 2017	FY 2017 Mandatory	FY 2018	FY 2019	FY 2020	FY 2021
B1R Design and Limited Renovation of Building 3	$12,000							
B1R Exterior Renovations	14,876							
B1R Wing 3	15,000							
B1R Wing 6	15,700							
B1R Swing Space	3,900							
B3R	15,000	$3,000						
B1R Wing 5		12,000	$10,000	$38,000				
Wing 4 and Limited Center Spine *				42,000				
B245M *	2,000	60,000	40,000	20,000				

** These projects will be completed with existing SCMMR as well as future additional CRF funding requests.*

PROGRAM CHANGES:

1. SCMMR Decrease (-$4.751 million, 0 FTE):

NIST requests a decrease in the amount of $4.751 million to reduce the SCMMR program to approximately $55.0 million for FY 2017.

PROGRAM CHANGE PERSONNEL DETAIL
(Dollars in thousands)

Budget Program: Construction and Major Renovations
Sub-program: Construction and Major Renovations
Program Change: SCMMR Decrease

No change in FTE is required.

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Budget Program: Construction and Major Renovations
Sub-program: SCMMR
Program Change: SCMMR Decrease

	Object Class	FY 2017 Decrease	FY 2017 Total Program
11	Personnel compensation		
11.1	Full-time permanent	0	$10,790
11.3	Other than full-time permanent	0	82
11.5	Other personnel compensation	0	292
11.8	Special personnel services payments	0	0
11.9	Total personnel compensation	0	11,164
12	Civilian personnel benefits	0	3,604
13	Benefits for former personnel	0	0
21	Travel and transportation of persons	0	29
22	Transportation of things	0	14
23.1	Rental payments to GSA	0	10
23.2	Rental Payments to others	0	0
23.3	Communications, utilities and miscellaneous charges	($38)	69
24	Printing and reproduction	0	5
25.1	Advisory and assistance services	0	0
25.2	Other services	(4,701)	27,972
25.3	Purchases of goods & services from Gov't accounts	(3)	207
25.4	Operation and maintenance of facilities	0	0
25.5	Research and development contracts	0	0
25.6	Medical care	0	0
25.7	Operation and maintenance of equipment	(3)	389
25.8	Subsistence and support of persons	0	0
26	Supplies and materials	(4)	1,377
31	Equipment	(2)	155
32	Lands and structures	0	50,000
33	Investments and loans	0	0
41	Grants, subsidies and contributions	0	0
42	Insurance claims and indemnities	0	0
43	Interest and dividends	0	0
44	Refunds	0	0
99	Total obligations	(4,751)	94,995

2. Radiation Physics Building 245 Modernization Decrease (-$20.0 million, 0 FTE):

NIST requests a decrease of $20.0 million to reflect the completion of the initial efforts to improve the condition of the Gaithersburg Radiation Physics Building 245 with funding received in FY 2016. This first segment of the multi-year project funded the migration of research requiring strict tolerances from antiquated space to modern facilities. Specifically, NIST will construct an addition that will provide approximately 41,000 gsf of new research area. The new B/C Wing addition will house laboratories requiring tighter environmental controls (temperature, humidity and air filtration) needed for today's research equipment that cannot be achieved in the existing facility plus approximately 19,000 gsf of new mechanical/infrastructure support space.

PROGRAM CHANGE PERSONNEL DETAIL
(Dollars in thousands)

Budget Program: Construction and Major Renovations
Sub-program: Construction and Major Renovations
Program Change: Radiation Physics Building 245 Modernization Decrease

No change in FTE is required.

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Budget Program: Construction and Major Renovations
Sub-program: Construction and Major Renovations
Program Change: Radiation Physics Building 245 Modernization Decrease

	Object Class	FY 2017 Decrease	FY 2017 Total Program
11	Personnel compensation		
11.1	Full-time permanent	0	$10,790
11.3	Other than full-time permanent	0	82
11.5	Other personnel compensation	0	292
11.8	Special personnel services payments	0	0
11.9	Total personnel compensation	0	11,164
12	Civilian personnel benefits	0	3,604
13	Benefits for former personnel	0	0
21	Travel and transportation of persons	0	29
22	Transportation of things	0	14
23.1	Rental payments to GSA	0	10
23.2	Rental Payments to others	0	0
23.3	Communications, utilities and miscellaneous charges	0	69
24	Printing and reproduction	0	5
25.1	Advisory and assistance services	0	0
25.2	Other services	0	27,972
25.3	Purchases of goods & services from Gov't accounts	0	207
25.4	Operation and maintenance of facilities	0	0
25.5	Research and development contracts	0	0
25.6	Medical care	0	0
25.7	Operation and maintenance of equipment	0	389
25.8	Subsistence and support of persons	0	0
26	Supplies and materials	0	1,377
31	Equipment	0	155
32	Lands and structures	($20,000)	50,000
33	Investments and loans	0	0
41	Grants, subsidies and contributions	0	0
42	Insurance claims and indemnities	0	0
43	Interest and dividends	0	0
44	Refunds	0	0
99	Total obligations	(20,000)	94,995

Exhibit 16

Department of Commerce
National Institute of Standards and Technology
Construction of Research Facilities
SUMMARY OF REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

	Object Class	2015 Actual	2016 Enacted	2017 Base	2017 Estimate	Increase/ (Decrease) Over 2017 Base
11	Personnel compensation					
11.1	Full-time permanent	$7,638	$10,722 1/	$10,790	$10,790	0
11.3	Other than full-time permanent	81	81	82	82	0
11.5	Other personnel compensation	292	292	292	292	0
11.9	Total personnel compensation	8,011	11,095	11,164	11,164	0
12.1	Civilian personnel benefits	2,459	3,455 1/	3,604	3,604	0
13	Benefits for former personnel	0	0	0	0	0
21	Travel and transportation of persons	39	29	29	29	0
22	Transportation of things	14	14	14	14	0
23.1	Rental payments to GSA	9	10	10	10	0
23.2	Rental payments to others	0	0	0	0	0
23.3	Communications, utilities, and miscellaneous charges	64	107	107	69	($38)
24	Printing and reproduction	5	5	5	5	0
25.1	Advisory and assistance services	0	0	0	0	0
25.2	Other services	23,626	32,460 1/	32,673	27,972	(4,701)
25.3	Purchases of goods and services from government accounts	200	207	210	207	(3)
25.5	Research and development contracts	0	0	0	0	0
25.7	Operation and maintenance of equipment	361	385	392	389	(3)
26	Supplies and materials	1,328	1,357	1,381	1,377	(4)
31	Equipment	145	153	157	155	(2)
32	Land and structures	3,445	93,851	70,000	50,000	(20,000)
41	Grants, subsidies, and contributions	0	699	0	0	0
43	Interest and dividends	0	0	0	0	0
99	Total Obligations	39,706	143,827	119,746	94,995	(24,751)

	Object Class	2015 Actual	2016 Enacted	2017 Base	2017 Estimate	Increase/ (Decrease) Over 2017 Base
99	Total Obligations	$39,706	$143,827	$119,746	$94,995	($24,751)
	Less Prior Year Recoveries	(2,218)	0	0	0	0
	Less Prior Year Unobligated Balance	(12,015)	(24,827)	0	0	0
	Plus Unobligated Balance End of Year	24,827	0	0	0	0
	Total Budget Authority/Appropriation	50,300	119,000	119,746	94,995	(24,751)
	Plus Transfers from Other Accounts	0	0	0	0	0
	Appropriation	50,300	119,000	119,746	94,995	(24,751)
	Personnel Data					
	Full-time equivalent employment:					
	Full-time permanent	82	120	120	120	0
	Other than full-time permanent	1	0	0	0	0
	Total	83	120	120	120	0
	Authorized Positions:					
	Full-time permanent	86	120	120	120	0
	Other than full-time permanent	1	0	0	0	0
	Total	87	120	120	120	0

[1/] Adjustments made to reflect labor direct charging per NIST management; implemented after FY 2016 Congressional Budget Request was submitted.

Department of Commerce
National Institute of Standards and Technology
Construction of Research Facilities
SUMMARY OF INFORMATION TECHNOLOGY RESOURCES
(Dollar Amounts in thousands)

IT Projects by Activity/Subactivity: (Totals by Activity)	Unique Invetsment Identifier	IT Investment Title	2015 Actual	2016 Enacted	2017 Estimate	Increase/ Decrease
Construction and Major Renovations			0	0	0	0
Total			0	0	0	0

Department of Commerce
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. $94,995,000 to remain available until expended.

3. Public Law 110-69, America Competes Act, 121 Stat 572, passed August 9, 2007 reauthorizes the Construction of Research Facilities appropriation through 2010. It also provided for the Retention of Fees to the Construction of Research Facilities account. "The Director is authorized to retain all building use and depreciation surcharge fees collected pursuant to OMB Circular A-25. Such fees shall be collected and credited to the Construction of Research Facilities Appropriation Account for use in maintenance and repair of the Institute's existing facilities". Public Law 111-358, America Competes Reauthorization Act, 2010, 124 Stat 3982, passed January 4, 2011 reauthorized the Construction of Research Facilities appropriation through 2013.

4. Public Law 111-5, American Recovery and Reinvestment Act of 2009 appropriated $360,000,000 to the Construction of Research Facilities appropriation from FY 2009 to FY 2010.

Exhibit 34

Department of Commerce
National Institute of Standards and Technology
Construction of Research Facilities
ADVISORY AND ASSISTANCE SERVICES
(Obligations in thousands of dollars)

	FY 2015 Actual	FY 2016 Estimate	FY 2017 Estimate
Management and professional support services	$0	$0	$0
Studies, analyses, and evaluations	0	0	0
Engineering and technical services	0	0	0
Total	0	0	0

Significant Activities

Professional support and engineering and technical services are obtained when required to support the construction and major repairs and renovations of NIST's physical infrastructures in Gaithersburg, Maryland, and Boulder, Colorado. Strategies and action plans are also developed to further ensure structural building safety when the need arises.

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.

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Working
Capital Fund

Exhibit 5

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
SUMMARY OF RESOURCE REQUIREMENTS
(Dollar amounts in thousands)

	Positions	FTE	Budget Authority	Obligations
2016 Enacted	638	689	$500	$500
Reduction in transfers from prior STRS program changes	0	0	(500)	(500)
2017 Base	638	689	0	0
Transfer from STRS program changes for equipment investments	0	0	500	500
2017 Estimate	638	689	500	500

Exhibit 6

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
SUMMARY OF REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Comparison by activity:	2015 Actual FTE	2015 Actual Amount	2016 Enacted FTE	2016 Enacted Amount	2017 Base FTE	2017 Base Amount	2017 Estimate FTE	2017 Estimate Amount	Increase/ (Decrease) Over 2017 Base FTE	Increase/ (Decrease) Over 2017 Base Amount
Laboratory programs										
WCF transfer		0		$500		0		$500		$500
Reimbursables	608	$136,361	629	159,696	629	$142,218	629	142,218	0	0
WCF investments	0	7,368	0	4,593	0	0	0	0	0	0
Subtotal	608	143,729	629	164,789	629	142,218	629	142,718	0	500
Corporate services										
WCF transfer		0		0		0		0		0
Reimbursables	0	3,415	0	3,709	0	3,765	0	3,765	0	0
WCF investments	0	83	0	349	0	0	0	0	0	0
Subtotal	0	3,498	0	4,058	0	3,765	0	3,765	0	0
Standards coordination and special programs										
WCF transfer		0		0		0		0		0
Reimbursables	38	7,276	39	5,423	39	4,210	39	4,210	0	0
WCF investments	0	913	0	(254)	0	0	0	0	0	0
Subtotal	38	8,189	39	5,169	39	4,210	39	4,210	0	0
Advanced manufacturing technology consortia										
WCF transfer		0		0		0		0		0
Reimbursables	0	0	0	0	0	0	0	0	0	0
WCF investments	0	2	0	(1)	0	0	0	0	0	0
Subtotal	0	2	0	(1)	0	0	0	0	0	0
Hollings manufacturing extension partnership										
WCF transfer		0		0		0		0		0
Reimbursables	0	40	0	0	0	0	0	0	0	0
WCF investments	0	12	0	(9)	0	0	0	0	0	0
Subtotal	0	52	0	(9)	0	0	0	0	0	0

Comparison by activity:	2015 Actual FTE	2015 Actual Amount	2016 Enacted FTE	2016 Enacted Amount	2017 Base FTE	2017 Base Amount	2017 Estimate FTE	2017 Estimate Amount	Increase/ (Decrease) Over 2017 Base FTE	Increase/ (Decrease) Over 2017 Base Amount
Baldrige performance excellence program										
WCF transfer		0		0		0		0		0
Reimbursables	20	80	21	80	21	90	21	90	0	0
WCF investments	0	0	0	0	0	0	0	0	0	0
Subtotal	20	80	21	80	21	90	21	90	0	0
Total, National Institute of Standards and Technology										
WCF transfer		0		500		0		500	0	500
Reimbursables	666	147,172	689	168,908	689	150,283	689	150,283	0	0
WCF investments	0	8,378	0	4,678	0	0	0	0	0	0
Grand Total	666	155,550	689	174,086	689	150,283	689	150,783	0	500

Exhibit 7

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
SUMMARY OF FINANCING
(Dollar amounts in thousands)

	2015 Actual	2016 Enacted	2017 Base	2017 Estimate	Increase/ (Decrease) Over 2017 Base
Total Obligations	$155,550	$174,086	$150,283	$150,783	$500
Offsetting collections from:					
Federal funds	(123,693)	(108,660)	(92,410)	(92,410)	0
Non-Federal sources	(35,905)	(64,926)	(57,873)	(57,873)	0
Total offsetting collections	(159,598)	(173,586)	(150,283)	(150,283)	0
Unobligated balance, start of year	(88,058)	(105,118)	(105,118)	(105,118)	0
Unobligated balance transferred	0	0			
Unobligated balance, end of year	105,118	105,118	105,118	105,118	0
Change in uncollected customer payments - Federal	(13,012)	0	0	0	0
Budget Authority	0	500	0	500	500
Financing:					
Transfer from other accounts	0	(500)	0	(500)	(500)
Appropriation	0	0	0	0	0

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund

This Working Capital Fund (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. 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, the sale of Standard Reference Materials (SRMs) and Baldrige Performance Excellence Program (BPEP) fees. 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.

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Exhibit 16

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
SUMMARY OF REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

	Object Class	2015 Actual	2016 Enacted	2017 Base	2017 Estimate	Increase/ (Decrease) Over 2017 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	0	0	0	0
31	Equipment	0	$500	0	$500	$500
32	Land and structures	0	0	0	0	0
41	Grants, subsidies, and contributions	0	0	0	0	0
99	Total Obligations	0	500	0	500	500

Personnel Data	2015 Actual	2016 Enacted	2017 Base	2017 Estimate	Increase/ (Decrease) Over 2017 Base
Full-time equivalent employment:					
Full-time permanent	603	623	623	623	0
Other than full-time permanent	63	66	66	66	0
Total	666	689	689	689	0
Authorized Positions:					
Full-time permanent	652	619	619	619	0
Other than full-time permanent	19	19	19	19	0
Total	671	638	638	638	0

Exhibit 23

Department of Commerce
National Institute of Standards and Technology
NIST Working Capital Fund
SUMMARY OF INFORMATION TECHNOLOGY RESOURCES
(Dollar Amounts in thousands)

IT Projects by Activity/Subactivity: (Totals by Activity)	Unique Investment Identifier	IT Investment Title	2015 Actual	2016 Enacted	2017 Estimate	Increase/ Decrease
NIST Working Capital Fund						
	006-000701100	NIST Administrative Support	$10,080	$10,377	$10,672	$295
	006-000704500	NIST Central IT Support for Science	2,845	2,931	3,016	85
	006-000702100	NIST Laboratories	2,970	3,066	3,165	99
	006-000702200	IT Infrastructure and Office Automation	24,567	25,222	25,898	676
	006-000702500	NIST IT Security Planning	4,765	4,908	5,054	146
	006-000702300	Enterprise Architecture & Planning	260	273	283	10
	006-000708000	Grants Management Information System	240	247	254	7
Total			45,727	47,024	48,342	1,318

Exhibit 34

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
ADVISORY AND ASSISTANCE SERVICES
(Obligations in thousands of dollars)

	FY 2015 Actual	FY 2016 Estimate	FY 2017 Estimate
Management and professional support services	$1,252	$2,000	2,259
Studies, analyses, and evaluations	15	16	16
Engineering and technical services	501	1,486	1,422
Total	1,768	3,502	3,697

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.

NIST Public Safety
Communications
Research Fund

Exhibit 5

Department of Commerce
National Institute of Standards and Technology
NIST Public Safety Communications Research Fund
SUMMARY OF RESOURCE REQUIREMENTS - MANDATORY APPROPRIATION
(Dollar amounts in thousands)

	Positions	FTE	Budget Authority	Direct Obligations	Appro-priation
2016 Enacted	0	0	0	0	0
2017 Adjustments to base	0	0	0	0	0
2017 Base Request	0	0	0	0	0
2017 Estimate	0	0	0	0	0

Comparison by program/sub-program:		2015 Actual		2016 Enacted		2017 Base		2017 Estimate		Increase/ (Decrease) Over 2017 Base	
		Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount
NIST Public Safety Communications Research Fund	Pos/Approp	0	0	0	0	0	0	0	0	0	0
	FTE/Obl.	0	0	0	0	0	0	0	0	0	0
Budget Authority/Appropriation - Mandatory Account		0	0	0	0	0	0	0	0	0	0

Note: Beginning in FY 2015, the NIST Public Safety Communications Research Fund (from offsetting collections) will obligate over several fiscal years.

Exhibit 6

Department of Commerce
National Institute of Standards and Technology
NIST Public Safety Communications Research Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

	2015 Actual		2016 Enacted		2017 Base		2017 Estimate		Increase/ (Decrease) Over 2017 Base	
Comparison by program/sub-program:	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
NIST Public Safety Communications Research Fund	0	0	18	$40,000	24	$60,000	27	$36,300	3	($23,700)

Note: Beginning in FY 2015, the NIST Public Safety Communications Research Fund (from offsetting collections) will obligate over several fiscal years.

Exhibit 7

Department of Commerce
National Institute of Standards and Technology
NIST Public Safety Communications Research Fund
SUMMARY OF FINANCING - MANDATORY APPROPRIATION
(Dollar amounts in thousands)

	2015 Actual	2016 Enacted	2017 Base	2017 Estimate	Increase/ (Decrease) Over 2017 Base
Total Obligations	0	$40,000	$60,000	$36,300	($23,700)
Offsetting collections from:					
Trust funds	($92,700)	(7,300)	0	0	0
Adjustments for:					
Unobligated balance, start of year (Mandatory)	0	(92,700)	($60,000)	(60,000)	0
Unobligated balance from offsetting collections, end of year	92,700	60,000	0	23,700	23,700
Budget Authority/Appropriation - Mandatory Account	0	0	0	0	0

Note: Beginning in FY 2015, the NIST Public Safety Communications Research Fund (from offsetting collections) will obligate over several fiscal years.

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Department of Commerce
National Institute of Standards and Technology
NIST Public Safety Communications Research Fund
PROGRAM AND PERFORMANCE: MANDATORY APPROPRIATION
(Dollar amounts in thousands)

Program: NIST Public Safety Communications Research Fund
Sub-program: NIST Public Safety Communications Research Fund

Line Item		2015 Actual FTE	2015 Actual Amount	2016 Enacted FTE	2016 Enacted Amount	2017 Base FTE	2017 Base Amount	2017 Estimate Personnel	2017 Estimate Amount	(Increase/ Decrease) Over 2017 Base FTE	(Increase/ Decrease) Over 2017 Base Amount
NIST Public Safety Communications Research Fund	Pos/Approp	0	0	0	0	0	0	0	0	0	0
	FTE/Obl.	0	0	0	0	0	0	0	0	0	0
Total	Pos/Approp	0	0	0	0	0	0	0	0	0	0
	FTE/Obl.	0	0	0	0	0	0	0	0	0	0

Note: Beginning in FY 2015, the NIST Public Safety Communications Research Fund (from offsetting collections) will obligate over several fiscal years.

MANDATORY ACCOUNT: NIST Public Safety Communications Research Fund

BUDGET PROGRAM: NIST Public Safety Communications Research Fund

As part of the Middle Class Tax Relief and Job Creation Act of 2012, NIST has resources through the Public Safety Communications Research Fund (PSCRF) to help develop cutting-edge wireless technologies for public safety users. By FY 2016 the PSCRF is authorized approximately $285.0 million in mandatory funds from spectrum auction proceeds for NIST. In partnership with industry and public safety organizations, NIST will conduct research and develop new standards, technologies and applications to advance public safety communications in support of the initiative's efforts to build an interoperable nationwide broadband network for first responders.

Exhibit 16

Department of Commerce
National Institute of Standards and Technology
NIST Public Safety Communications Research Fund
SUMMARY OF REQUIREMENTS BY OBJECT CLASS - REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

	Object Class	2015 Actual	2016 Enacted	2017 Estimate
11	Personnel compensation			
11.1	Full-time permanent	0	$1,847	$2,635
11.3	Other than full-time permanent	0	0	0
11.5	Other personnel compensation	0	0	0
11.9	Total personnel compensation	0	1,847	2,635
12.1	Civilian personnel benefits	0	576	862
13	Benefits for former personnel	0	0	0
21	Travel and transportation of persons	0	127	129
22	Transportation of things	0	47	28
23.1	Rental payments to GSA	0	0	0
23.2	Rental payments to others	0	0	0
23.3	Communications, utilities, and miscellaneous charges	0	4,688	4,364
24	Printing and reproduction	0	20	19
25.1	Advisory and assistance services	0	1,900	0
25.2	Other services	0	16,327	8,263
25.3	Purchases of goods and services from government accounts	0	2,483	2,268
25.5	Research and development contracts	0	1,200	6,300
25.7	Operation and maintenance of equipment	0	551	390
26	Supplies and materials	0	439	541
31	Equipment	0	3,495	2,176
32	Land and structures	0	0	0
41	Grants, subsidies, and contributions	0	6,300	8,325
42	Insurance claims and indemnities	0	0	0
99	Total Obligations	0	40,000	36,300

	Object Class	2015 Actual	2016 Enacted	2017 Estimate
99	Total Obligations	0	40,000	36,300
	Unobligated balance from offsetting collections, start of year	0	(92,700)	(60,000)
	Unobligated balance from offsetting collections, end of year	$92,700	60,000	23,700
	Budgetary Resources - Mandatory Account	92,700	7,300	0
	Less: Offsetting collections	(92,700)	(7,300)	0
	Net Budget Authority - Mandatory Account	0	0	0

Personnel Data

Full-time equivalent employment:			
Full-time permanent	0	18	27
Other than full-time permanent	0	0	0
Total	0	18	27
Authorized Positions:			
Full-time permanent	0	24	36
Other than full-time permanent	0	0	0
Total	0	24	36

Note: Beginning in FY 2015, the NIST Public Safety Communications Research Fund (from offsetting collections) will obligate over several fiscal years.

Department of Commerce
National Institute of Standards and Technology
WIRELESS INNOVATION FUND
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. 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.

2. MANDATORY ACCOUNT: Wireless Innovation (WIN) Fund: As part of the National Wireless Initiative included in the American Jobs Act, NIST also has resources through the Wireless Innovation (WIN) Fund to help develop cutting-edge wireless technologies for public safety users. The WIN Fund contains $300 million in mandatory funds for NIST from the spectrum auction proceeds to help industry and public safety organizations conduct research and develop new standards, technologies and applications to advance public safety communications in support of the initiative's efforts to build an interoperable nationwide broadband network for first responders.
P.L. 112-96 established the Public Safety Communications Research Fund per section 6303 of the Middle Class Tax Relief and Job Creation Act of 2012. The fund's availability extends through 2022 and began to execute in FY 2015. $92.7 million was transferred to NIST in FY 2015. Currently $100 million is apportioned in FY 2016 with $60 million of this currently designated as funding to be obligated in 2017 and 2018. Additional transfers to NIST from NTIA are expected as proceeds from the spectrum auctions become available.

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National Network for
Manufacturing Innovation

Exhibit 5

Department of Commerce
National Institute of Standards and Technology
National Network for Manufacturing Innovation
SUMMARY OF RESOURCE REQUIREMENTS - MANDATORY APPROPRIATION
(Dollar amounts in thousands)

	Positions	FTE	Budget Authority	Direct Obligations	Appro-priation
2016 Enacted	0	0	0	0	0
2017 Adjustments to base	0	0	0	0	0
2017 Base Request	0	0	0	0	0
plus: FY 2017 Program Changes	0	0	$1,890,000	$1,890,000	$1,890,000
less: Unobligated balance at EOY	0	0	0	(1,890,000)	0
2017 Estimate	0	0	1,890,000	0	1,890,000

		2015 Actual		2016 Enacted		2017 Base		2017 Estimate		Increase/ (Decrease) Over 2017 Base	
Comparison by program/sub-program:		Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount
National Network for Manufacturing Innovation											
National Network for	Pos/Approp	0	0	0	0	0	0	0	$1,890,000	0	$1,890,000
Manufacturing Innovation	FTE/Obl.	0	0	0	0	0	0	0	0	0	0
Total: National Network for	Pos/Approp	0	0	0	0	0	0	0	1,890,000	0	1,890,000
Manufacturing Innovation	FTE/Obl.	0	0	0	0	0	0	0	0	0	0
Adjustments for:											
Unobligated balance, EOY			0		0		0		1,890,000		1,890,000
Budget Authority/Appropriation - Mandatory Account			0		0		0		1,890,000		1,890,000

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Department of Commerce
National Institute of Standards and Technology
National Network for Manufacturing Innovation
PROGRAM AND PERFORMANCE: MANDATORY APPROPRIATION
(Dollar amounts in thousands)

Program: National Network for Manufacturing Innovation
Sub-program: National Network for Manufacturing Innovation

Line Item		2015 Actual		2016 Enacted		2017 Base		2017 Estimate		(Increase/ Decrease) Over 2017 Base	
		Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount	Per-sonnel	Amount
National Network for Manufacturing Innovation	Pos/Approp	0	0	0	0	0	0	0	$1,890,000	0	$1,890,000
	FTE/Obl.	0	0	0	0	0	0	0	0	0	0
Total	Pos/Approp	0	0	0	0	0	0	0	1,890,000	0	1,890,000
	FTE/Obl.	0	0	0	0	0	0	0	0	0	0

MANDATORY APPROPRIATIONS ACCOUNT: NATIONAL NETWORK FOR MANUFACTURING INNOVATION (NNMI)

BUDGET PROGRAM: National Network for Manufacturing Innovation (NNMI)

As part of government-wide efforts to revitalize U.S. manufacturing, the FY 2017 President's Budget proposes one-time NNMI mandatory funding of $1.890 billion in FY 2017 to be executed from FY 2018 – FY 2025 in order to stand up 27 new manufacturing innovation institutes. The $1.890 billion request would allow completion of the vision for the National Network for Manufacturing Innovation (NNMI), a network of up to 45 institutes where researchers, companies, universities, community colleges, and entrepreneurs can come together to develop new manufacturing technologies with broad applications, as well as training the workforce needed to work in advanced manufacturing industries, thereby nurturing innovation and accelerating commercialization.

Each institute would be industry-led, have a unique technology focus, and would leverage ecosystems of manufacturing activity in local and regional communities. The institutes would support manufacturing technology commercialization and productivity by creating a shared "industrial commons" bridging the gap from R&D to product development and manufacturing here in the U.S. A network leadership council will disseminate best practices and facilitate collaboration among the institutes. Program coordination will be led by a NIST-hosted, inter-agency Advanced Manufacturing National Program Office.

Federal funding serves as the initial catalyst in the formation of these public-private partnerships; the federal investment must be at least 100% matched by non-federal sources over the five to seven year institute startup period. Mandatory funding provides the planning confidence for the private sector to co-invest in these institutes. The program is designed to support institutes that would be financially self-sustaining as they demonstrate value for industry to continue sponsorship.

A more detailed description of the NNMI's goals and objectives is available in the National Science and Technology Council (NSTC) January 2013 report, "National Network for Manufacturing Innovation: A Preliminary Design."

BASE JUSTIFICATION:

The NNMI was a new program first funded in FY 2016 at $25.0 million with Congressionally appropriated discretionary funds. This funding is sufficient to stand up and fund one or two manufacturing innovation institutes and to fund the Advanced Manufacturing National Program Office at NIST to provide NNMI network support as required by the Revitalize American Manufacturing and Innovation Act (RAMI). In FY 2017, the President's Budget request includes a $22.0 million increase for the program, for a total of $47.0 million in discretionary funds, to fund and maintain three Institutes for up to seven years each and coordinate the Network activities of all institutes in the NNMI. This one-time mandatory funding request is needed to reach government-wide vision of a network of up to 45 institutes for the NNMI.

One Time FY 2017 Mandatory Funding of $1.890 billion for the National Network for Manufacturing Innovation (NNMI):

The mandatory funds requested in FY 2017 will fund the activities described below.

Proposed Actions: Strengthen the U.S. manufacturing sector through collaborative investments in a network of manufacturing innovation institutes. These institutes will address manufacturing challenges with broad applications and mature emerging technologies and their manufacturing readiness.

Prior to Congressional authorization of the NNMI in December 2014, eight pilot institutes were awarded or in competition. The first pilot institute, on the topic of additive manufacturing or "3D printing," was announced in August 2012. Located in Youngstown, Ohio, and known as *America Makes*, the center currently has over 140 member institutions, including universities, community colleges and nonprofits, along with large and small manufacturers (such as the global leader in additive manufacturing, 3-D Systems).

Following the launch of this successful pilot institute, a national competition was held which led to the selection in early 2014 of three new institutes - in North Carolina, Chicago and Detroit - in the areas of power electronics manufacturing, digital manufacturing and design innovation, and lightweight modern metals manufacturing. This was followed in 2015 by competitions for five additional institutes by the Department of Energy (DoE) and the Department of Defense (DoD) in composites manufacturing, integrated photonics, flexible hybrid electronics, smart manufacturing, and revolutionary fibers and textiles. Six additional institutes will be awarded using FY 2016 funding, with the Department of Commerce (DOC), DoE, and DoD each awarding two. In 2017, a third DOC institute would be awarded by DOC as described in the FY 2017 President's discretionary budget request. With these awards, there would be a total of 16 manufacturing innovation institutes, out of the total of 45 proposed for the Network. As required by RAMI, the DOC institutes will be competed and awarded using "open-topic" competitions where the topics are proposed by U.S. industry as being of highest need for the nation.

With the passage of the RAMI Act in December 2014, all institutes funded by DoD and DoE joined institutes funded by DOC and became part of the national network. To ensure individual institutes achieve their full potential to advance American domestic manufacturing, RAMI directs NIST coordinate NNMI activities in order to: expand the impacts of individual institutes; develop crosscutting metrics and methods for evaluating impact of the network; provide shared services for efficiency; and promulgate best practices and standards. Each institute participates in the broader network. The institutes are designed to avoid directly competing with each other. They have diverse goals and technical domains, and cooperate in areas where it makes sense. Together they share the national mission of improving U.S. manufacturing competitiveness.

This mandatory funding will continue fulfilling the vision for the NNMI authorized by RAMI. The funds provided will stand up additional institutes promoting direct collaboration on industry-relevant research and development to address emerging technology areas where U.S. market failures are allowing other countries to gain economic benefits from scaling up U.S. innovations and inventions. The institutes will facilitate U.S. manufacturers to share their research and development efforts to allow manufacturing of laboratory innovations, and facilitate the adoption of new manufacturing technologies, tools, and methodologies that will make U.S. manufacturers more competitive. The NNMI will emphasize outreach and engagement with small and medium-sized manufacturing enterprises, including women and minority owned manufacturing enterprises. Institutes will provide shared state-of-the-art facilities for workforce training, including the education and training of veterans and individuals with disabilities.

The following goals will be addressed through focused actions:

- In accordance with the RAMI Act, NIST has the authority to establish and manage the NNMI network to provide efficiencies of resources, including developing network governance processes to support productive interactions among institutes. Specifically NIST works with other agencies, including DOE, DOD, USDA, NSF, and NASA, as well as the prior pilot institutes, to establish frameworks for performance evaluation, risk management, communication and operations, and for supporting coordination among the institutes. In addition, NIST, through the Advanced Manufacturing National Program Office (AMNPO), aggregates and shares best practices and provides common services which institutes can take advantage of to avoid duplication of efforts for both standing up new institutes or for on-going operations.
- The RAMI Act authorizes NIST to run open competitions for additional institutes on topics proposed by industry, thereby addressing U.S. industry needs beyond government needs in defense, energy, and other agency mission-driven requirements. As additional institutes are created, NIST will contribute its unique expertise to the coordination of issues, opportunities and practices to ensure that use of resources is optimized.

These actions will provide a critical aspect of the manufacturing innovation infrastructure needed to advance U.S. manufacturing, as highlighted in the "Accelerating U.S. Advanced Manufacturing" Report from the President's Council of Advisors on Science and Technology.[1] The actions in this initiative directly support the Department of Commerce's strategic goals for manufacturing. This initiative would make progress on the key strategy "Establish the National Network for Manufacturing Innovation" in the Innovation Pillar of the Department of Commerce's 2014-2018 Strategic Plan, specifically addressing Strategic Objective 2.1: "Grow a more productive, agile, and high-value manufacturing sector through partnerships and collaborations that accelerate technology development and commercialization."

The proposed actions are designed to create a NNMI that will:

- Induce industry and non-federal co-investment to rapidly seize innovation opportunities that lead to industrial capabilities, bridging the gaps to enable fundamental technical discoveries made in the U.S. to result in products manufactured in the U.S.;
- Promote direct collaboration on industry-relevant research and development to address emerging technology areas where market failures are causing U.S. innovations to be scaled up and manufactured in other countries;
- Optimize the impact of individual institutes within the network, in developing manufacturing processes for the nation's inventions and innovations, and enabling workforce training needed for advanced manufacturing in the U.S.; and,
- Facilitate the adoption of new manufacturing technologies, tools, and methodologies that will make U.S. manufacturers more competitive, especially recognizing the role of small and medium manufacturers in supply chains and innovation.

Action 1: Build and Grow the NNMI Network

To ensure the NNMI institutes fully leverage their potential to advance American domestic manufacturing, NIST will support and expand the impacts of individual institutes, develop crosscutting metrics and methods for evaluating impact, and offer best practices and standards. Each institute

[1] http://www.whitehouse.gov/sites/default/files/microsites/ostp/PCAST/amp20_report_final.pdf

participates in the broader National Network; the purposes and functions of which are to foster inter-institute collaboration and maximize overall institute impact.

To the extent possible, the institutes should work collaboratively, sharing best practices and where useful, research and development results. The institutes are not directly competitive, as the institutes have diverse goals and technical areas, but rather they share the national mission of improving U.S. manufacturing competitiveness. Each new institute that is awarded joins the network of institutes and contributes to the ever growing collection of coordinated centers.

Action 2: Implement the NNMI Network Functions

NIST is responsible to convene the NNMI network. Among the most pressing roles, NIST organizes meetings of the network and facilitates interagency processes to develop and share best practices for efficient operation of the institutes. NIST will facilitate for the Network interactions with small and medium manufacturers (working with the Hollings Manufacturing Extension Partnership), collaboration and interactions across the Network, and allow institutes to share services. While recognizing the differing needs of various manufacturing sectors, clusters, and ecosystems, the network will strive, as far as is practical, to share common policies with regard to intellectual property, contract research, operations, accountability, and marketing and branding, and at the same time maintain the flexibility to work with requirements necessary for network institutes stood up by other agencies or other entities as allowed by RAMI.

To support this action, NIST will further refine and develop the NNMI network oversight and management structure composed of representatives of the institutes, federal agencies, and other appropriate entities, recognizing that the optimal network function will evolve as the NNMI program grows. The network management actively looks for opportunities to leverage existing resources between institutes.

Action 3: Establish Additional Institutes through Open Competitions

NIST will manage solicitations for establishing 29 new institutes spread across FY 2017, 2018, 2019, 2020, and 2021 under this initiative, using a competition process open to any topic proposed by industry. The institute selection process will be managed by the NIST Advanced Manufacturing Office (NIST AMO). NIST AMO will be responsible for managing an open, competitive selection process and for executing the award process. The design and exact number of solicitations will depend on the availability and timing of funds, and size of awards which may vary, as described in the January 2013 OSTP publication "National Network for Manufacturing Innovation: A Preliminary Design". Proposals received in response to the solicitation(s) will be evaluated competitively by a review team that includes NIST staff, agency partners, and manufacturing experts with relevant experience from industry and academia. The merit based selection process may include pre-proposals, planning grants, site visits, and economic and business plan analyses. This broad, deliberative review process will balance the most essential U.S. industrial needs and promising opportunities, while supporting the goals of enhancing American industrial competitiveness on regional, national and global bases.

Statement of Need and Economic Benefits

U.S. competitive advantage in manufacturing requires continual innovation, for which the U.S. is known as the world's leader. U.S. inventions and innovations are commonly adopted for manufacturing in other countries who provide government support for scale up, since the high cost and risk of development of new manufacturing processes often precludes development by individual

companies. Manufacturers must innovate with new processes, materials and technologies or risk commoditization and being left behind in the profitable market for new and improved advanced technology products. Furthermore, advanced manufacturing capabilities based on continual innovation are difficult to move or replicate in other locations. These capabilities are increasingly dispersed globally, requiring even greater emphasis on speed and novelty in order to achieve innovation acceleration. Innovation requires risk. It is unpredictable yet also essential to the creation of the new and improved products needed to remain globally competitive.

A trend has emerged where other countries are increasingly adept at technology transfer and scaling from laboratory demonstration to production (including development of U.S. inventions), enabled substantially with government support. These competitors to the U.S. have focused on creating a more structured technology development process by partnering with industry. Partnerships that bring diverse organizations together to accelerate innovation for advanced manufacturing create a stronger innovation system. Those innovations are then linked more directly to domestic production capabilities. Innovation system gaps lead to market failures and these failures are magnified in advanced manufacturing. U.S. manufacturers individually are challenged to fund these technology development functions. Small manufacturers especially struggle with individually investing in prototyping and scale up of new technologies and potential products.

This effort would help catalyze a critical mass of renewed private sector investment in manufacturing processes by promoting shared resources and knowledge base within an industry sector that is necessary to address these challenges, thereby minimizing the stranding U.S. innovations that are not brought to fruition within the U.S.

Schedule and Milestones

Action 1: Build and Grow the NNMI Network

- Establish a multiyear roadmap of NNMI Network goals and functions. (Complete in 2017)
- Ascertain and document best practices. (Version 1 complete in 2017)
- Complete documentation and reporting as required by RAMI Legislation. (2017 - 2025)

Action 2: Implement the NNMI Network Functions

- Refine the NNMI Network governance structure to reflect the Network's evolving composition. (Complete in 2017)
- Develop policies and support needed for efficient network management. (Complete in 2017)
- Convene semi-annual NNMI meetings of representatives from each institute. (2017 - 2025)
- Report on network activities. (2017 - 2025)

Action 3: Establish Additional DOC institutes through Open Competition

- Develop internal NIST policy documents necessary for ongoing institute competitions and management. (Complete in 2017)
- Hold open topics competitions for NNMI planning awards as a scalable approach to fund out-year institute awards as required by RAMI. (Initiated in 2017)
- Hold competition for institute awards with open topics consistent with and required by RAMI. (First funding opportunity published in 2018)

- Award new institute(s). (Up to seven institute awards per competition cycle, first cycle begins by 2018)

Deliverables

Action 1: Build and Grow the NNMI Network

- Multiyear roadmap of Network goals and functions
- Best practices document for agency and NIST funded institutes. (Complete by 2018)
- Report to Congress and assessment by GAO. (2017 - 2024)

Action 2: Implement the NNMI Network Functions

- Governance documents. (Complete in 2017)
- Policy documents issued on branding, data infrastructure and performance measures, intellectual property practices, legislative reporting requirements, network structure and communication, coordination and collaboration. (Complete in 2017)
- Develop services, such as databases, to be used by new or existing institutes for efficiency, quality, and avoidance of duplication of efforts. (Complete in 2017)
- Policy documents issued on open data, technology transfer, and network participation by other entities. (Complete in 2017)
- NNMI Network annual reports. (2017 - 2025)

Action 3: Establish Additional institutes through Open Competition

- NIST award policy documents covering cost share approach, external evaluators, academic and industry fellows, and program income. (Complete in 2017)
- NIST award policy documents covering post-award management. (Complete in 2018)
- Federal Funding Opportunity to determine industry input and planning for institutes via open topic competition. (Complete in 2018)
- Federal Funding Opportunity for manufacturing institutes consistent with open topics or those selected by industry. (Complete in stages 2017-2022)
- Cooperative agreements in place to establish manufacturing institutes. (Complete in stages 2018-2022)

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Exhibit 16

Department of Commerce
National Institute of Standards and Technology
National Network for Manufacturing Innovation
SUMMARY OF REQUIREMENTS BY OBJECT CLASS - MANDATORY APPROPRIATION
(Dollar amounts in thousands)

	Object Class	2015 Actual	2016 Enacted	2017 Estimate
11	Personnel compensation			
11.1	Full-time permanent	0	0	0
11.3	Other than full-time permanent	0	0	0
11.5	Other personnel compensation	0	0	0
11.9	Total personnel compensation	0	0	0
12.1	Civilian personnel benefits	0	0	0
13	Benefits for former personnel	0	0	0
21	Travel and transportation of persons	0	0	0
22	Transportation of things	0	0	0
23.1	Rental payments to GSA	0	0	0
23.2	Rental payments to others	0	0	0
23.3	Communications, utilities, and miscellaneous charges	0	0	0
24	Printing and reproduction	0	0	0
25.1	Advisory and assistance services	0	0	0
25.2	Other services	0	0	0
25.3	Purchases of goods and services from government accounts	0	0	0
25.5	Research and development contracts	0	0	0
25.7	Operation and maintenance of equipment	0	0	0
26	Supplies and materials	0	0	0
31	Equipment	0	0	0
32	Land and structures	0	0	0
41	Grants, subsidies, and contributions	0	0	0
42	Insurance claims and indemnities	0	0	0
99	Total Obligations	0	0	0

	Object Class	2015 Actual	2016 Enacted	2017 Estimate
99	Total Obligations	0	0	0
	Unobligated balance, end of year	0	0	$1,890,000
	Budget Authority - Mandatory Account	0	0	1,890,000
	Personnel Data			
	Full-time equivalent employment:			
	Full-time permanent	0	0	0
	Other than full-time permanent	0	0	0
	Total	0	0	0
	Authorized Positions:			
	Full-time permanent	0	0	0
	Other than full-time permanent	0	0	0
	Total	0	0	0

Exhibit 5

Department of Commerce
National Institute of Standards and Technology
Construction of Research Facilities
SUMMARY OF RESOURCE REQUIREMENTS - MANDATORY APPROPRIATION
(Dollar amounts in thousands)

	Positions	FTE	Budget Authority	Direct Obligations	Appro-priation
2016 Enacted	0	0	0	0	0
2017 Adjustments to base	0	0	0	0	0
2017 Base Request	0	0	0	0	0
plus: FY 2017 Program Changes	0	0	$100,000	$100,000	$100,000
2017 Estimate	0	0	100,000	100,000	100,000

Comparison by program/sub-program:		2015 Actual Per-sonnel	2015 Actual Amount	2016 Enacted Per-sonnel	2016 Enacted Amount	2017 Base Per-sonnel	2017 Base Amount	2017 Estimate Per-sonnel	2017 Estimate Amount	Increase/ (Decrease) Over 2017 Base Per-sonnel	Increase/ (Decrease) Over 2017 Base Amount
Construction and Major Renovations											
Construction and Major	Pos/Approp	0	0	0	0	0	0	0	$100,000	0	$100,000
renovations	FTE/Obl.	0	0	0	0	0	0	0	100,000	0	100,000
Total: Construction and Major	Pos/Approp	0	0	0	0	0	0	0	100,000	0	100,000
renovations	FTE/Obl.	0	0	0	0	0	0	0	100,000	0	100,000
Adjustments for:											
Unobligated balance, EOY			0		0		0		0		0
Budget Authority/Appropriation - Mandatory Account			0		0		0		100,000		100,000

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Department of Commerce
National Institute of Standards and Technology
Construction of Research Facilities
PROGRAM AND PERFORMANCE: MANDATORY APPROPRIATION
(Dollar amounts in thousands)

Program: Construction and major renovations
Sub-program: Construction and major renovations

Line Item		2015 Actual		2016 Enacted		2017 Base		2017 Estimate		(Increase/ Decrease) Over 2017 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount
Construction and major renovations	Pos/Approp	0	0	0	0	0	0	0	$100,000	0	$100,000
	FTE/Obl.	0	0	0	0	0	0	0	100,000	0	100,000
Total	Pos/Approp	0	0	0	0	0	0	0	100,000	0	100,000
	FTE/Obl.	0	0	0	0	0	0	0	100,000	0	100,000

MANDATORY APPROPRIATIONS ACCOUNT: CONSTRUCTION OF RESEARCH FACILITIES

BUDGET PROGRAM: Construction and Major Renovations

In addition to the discretionary funding request for CRF, authorizing legislation will be proposed that would provide $100.0 million in mandatory funds to renovate and modernize NIST facilities in order to maintain and enhance current research and development capabilities. NIST would utilize the funding to execute the next phases of construction requirements at its Gaithersburg, Maryland and Boulder, Colorado sites.

Without proper and reliable facilities and infrastructure, the work and research being conducted and relied upon, not just by the U.S. but also globally, is at risk of failure. For instance, NIST work conducted in Gaithersburg's Building 245 plays a critical role at the apex of calibrations, radioactivity and dose measurements, and neutron dosimetry for many U.S. industries. This work has critical impact on multiple sectors of the economy and directly affects consumer safety with food irradiation; worker safety with radiation protection; environmental health with environmental monitoring; public safety through Homeland Security applications, and public health through medical applications. Risks if the modernization to Building 245 is not funded include the inability to develop test methods and validation of standards for radiation detection equipment as required by the Department of Homeland Security (Safe Port Act); sample degradation and contamination; research inefficiencies; inability to provide mandated measurement and calibration services to other federal agencies; and ultimately the potential failure of building equipment and systems. Some examples of technologies relying on traceability to NIST include: mammography; external radiation beam therapies (cancer treatment); internal radiation therapies; metabolic studies; and medical device sterilization.

Building system failures and poor building infrastructure performance severely impact the ability for NIST to conduct its mission – causing downtime for laboratories and jeopardizing NIST's role as a leading research institiution. Facilities deficiencies at NIST Boulder's Building 1 causes productivity loss of at least 20 percent,[1] and in the past nine years the economic impact can conservatively be estimated at over a $1.0 billion.[2] In terms of lost productivity, many measurements can only be conducted sporadically when environmental conditions are temporarily stable and construction of nanoscale devices becomes worthless due to poor laboratory conditions. Types of research affected include advanced spectroscopies for non-invasive medical diagnostics and chemical detection, and development of "NIST-on-a-chip" technologies to bring ultraprecise NIST measurements into end user applications. Customers of electromagnetic measurements require higher frequency metrology at greater precision; for material measurements the need is for metrology at the atomic scale; and NIST Boulder will not be able to meet customer needs that require the fabrication of metrology devices to ever more stringent dimensional, purity and performance specifications.

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[1] *NIST Boulder Facilities Review Team, Report on NIST Boulder Laboratory Facilities: Findings and Recommendations on Possible Renovation of Existing Facilities and Possible Construction of New Laboratory Facilities, January 31, 2006.*

[2] The report cited above estimates a direct annual cost of $13 million in lost productivity for NIST due to forced laboratory downtimes and an impact to the nation on the order of $130 million per year due to delays and shut downs due to facility conditions.

Funding Estimates ($ in millions):

NIST Facility Requirement Description	FY 2016 Enacted	FY 2017 PB	FY 2017 Mandatory	Additional NIST Construction Requirements
Building 245 Modernization	$60.0	$40.0	$20.0	$202.5
Building 1 Renovation [1/]	$15.0	$10.0	$80.0	$14.0
SCMMR	$44.0	$45.0		
Total	$119.0	$95.0	$100.0	

1/ Partial Building 1 renovation as identified in FY 2006 to fulfull Boulder space requirements.

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Exhibit 16

Department of Commerce
National Institute of Standards and Technology
Construction of Research Facilities
SUMMARY OF REQUIREMENTS BY OBJECT CLASS - MANDATORY APPROPRIATION
(Dollar amounts in thousands)

	Object Class	2015 Actual	2016 Enacted	2017 Estimate
11	Personnel compensation			
11.1	Full-time permanent	0	0	0
11.3	Other than full-time permanent	0	0	0
11.5	Other personnel compensation	0	0	0
11.9	Total personnel compensation	0	0	0
12.1	Civilian personnel benefits	0	0	0
13	Benefits for former personnel	0	0	0
21	Travel and transportation of persons	0	0	0
22	Transportation of things	0	0	0
23.1	Rental payments to GSA	0	0	0
23.2	Rental payments to others	0	0	0
23.3	Communications, utilities, and miscellaneous charges	0	0	0
24	Printing and reproduction	0	0	0
25.1	Advisory and assistance services	0	0	0
25.2	Other services	0	0	0
25.3	Purchases of goods and services from government accounts	0	0	0
25.5	Research and development contracts	0	0	0
25.7	Operation and maintenance of equipment	0	0	0
26	Supplies and materials	0	0	0
31	Equipment	0	0	0
32	Land and structures	0	0	$100,000
41	Grants, subsidies, and contributions	0	0	0
42	Insurance claims and indemnities	0	0	0
99	Total Obligations	0	0	100,000

	Object Class	2015 Actual	2016 Enacted	2017 Estimate
99	Total Obligations	0	0	100,000
	Unobligated balance, end of year	0	0	0
	Budget Authority - Mandatory Account	0	0	100,000

Personnel Data

Full-time equivalent employment:				
	Full-time permanent	0	0	0
	Other than full-time permanent	0	0	0
	Total	0	0	0
Authorized Positions:				
	Full-time permanent	0	0	0
	Other than full-time permanent	0	0	0
	Total	0	0	0

Summary of 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 Discretionary Program

(Obligations in thousands)

	FY 2015			FY 2016			FY 2017			
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	2,412	2,373	$697,451	2,481	2,477	$719,428	2,522	2,523	$735,532	$730,533
Industrial technology services	85	80	157,081	97	97	184,900	99	96	188,991	188,991
Construction of research facilities	87	83	39,706	120	120	143,827	120	120	94,995	94,995
Gifts and bequests	21	20	3,755	18	20	4,364 [3/]	18	20	3,500 [3/]	0
Total, direct funding	2,605	2,556	897,993	2,716	2,714	1,052,519	2,759	2,759	1,023,018	1,014,519
Reimbursable Funding and WCF Investments										
Construction of research facilities - building surcharge	0	0	892	0	0	919	0	0	0	
Research, development and supporting services:										
Federal government	430	426	95,558	409	442	108,660	409	442	92,410	
Calibrations and tests, technical and advisory services:										
Federal government	33	33	7,526	31	34	8,370	31	34	7,884	
Public and non-federal government	79	79	22,889	77	82	25,459	77	82	23,978	
Subtotal, Services	112	112	30,415	108	116	33,829	108	116	31,862	
National Voluntary Laboratory Accreditation Program	23	23	4,092	22	23	4,432	22	23	3,977	
Standard reference materials (SRMs):										
SRM Sales:										
Federal government	3	3	741	3	4	885	3	4	888	
Public and non-federal government	82	82	17,649	78	84	21,102	78	84	21,146	
Subtotal, SRM sales	85	85	18,390	81	88	21,987	81	88	22,034	
SRM investment adjustment	0	0	(1,282)	0	0	0	0	0	0	
Subtotal, SRM	85	85	17,108	81	88	21,987	81	88	22,034	
Total, Reimbursable program	650	646	148,065 [2/]	620	669	169,827 [2/]	620	669	150,283	
WCF Investments and Operating Adjustments										
WCF investments	0	0	25,636	0	0	24,362	0	0	24,004	
WCF transfers	0	0	0	0	0	500	0	0	500	
WCF operating adjustments	0	0	3,454	0	0	0	0	0	0	
Total, WCF Investments and operating adjustments	0	0	29,090	0	0	24,862	0	0	24,504	
Total, NIST program	3,255	3,202	1,075,148	3,336	3,383	1,247,208	3,379	3,428	1,197,805	
Offsetting adjustment for amortization of equipment	0	0	(20,713)	0	0	(19,684)	0	0	(24,004)	
Adjusted total, NIST program	3,255	3,202	1,054,435	3,336	3,383	1,227,524	3,379	3,428	1,173,801	

[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.

[2/] Total reimbursable numbers are different from the next page due to inclusion of CRF reimbursable obligations.

[3/] Estimate support from Foundation for the Malcolm Baldrige National Quality Award, Inc. to Baldrige Performance Excellence Program.

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

	FY 2015 Actual	FY 2016 Enacted	FY 2017 Estimate
Department of Defense			
Air Force	$10,359	$6,470	$6,440
Army	469	831	950
Navy	627	1,649	1,477
Other, Department of Defense	15,945	15,511	13,713
Subtotal, Department of Defense	27,400	24,461	22,580
Department of Commerce	23,889	28,426	27,966
Department of Energy	4,192	4,527	3,800
Dept. of Health & Human Services	5,606	7,494	5,357
Dept. of Homeland Security	14,302	18,960	15,314
Department of Justice	5,094	9,641	5,300
Department of Transportation	554	745	350
Department of the Treasury	143	57	0
Department of Veterans Affairs	155	210	200
Environmental Protection Agency	86	147	100
General Services Administration	211	627	541
National Aeronautics & Space Admin.	2,459	2,513	2,723
National Science Foundation	2,805	2,775	2,500
Nuclear Regulatory Commission	2,514	2,500	2,400
Other	6,148	5,577	3,279
Subtotal, Other Agency	95,558	108,660	92,410
Calibrations & Testing	7,720	8,244	7,575
Technical & Advisory Services	26,786	30,018	28,264
Standard Reference Materials	17,108	21,986	22,034
Subtotal, Other Reimbursables	51,614	60,248	57,873
Total, Reimbursable Program	147,172	168,908	150,283
Equipment Transfers	0	500	500
Subtotal, WCF transfer	0	500	500
Equipment Investments	25,637	24,362	24,004
IE Amortization	(20,713)	(19,684)	(24,004)
WCF Operating Adjustments	3,454	0	0
Total, WCF Investments	8,378	4,678	0
Total, Reimbursable Program and WCF Investments	155,550	174,086	150,783

Department of Commerce
National Institute of Standards and Technology
PERIODICALS, PAMPHLETS, AND AUDIOVISUAL SERVICES
(Obligations in thousands)

	2014 Actual	2015 Estimate	2016 Estimate	2017 Estimate
Periodicals	0	0	0	0
Pamphlets	$15.3	$12.7	$15	$15
Audiovisuals	24.3	35.0	40	40
Total	39.6	47.7	55	55

NIST produces one periodical a year, *The Journal of Research of the National Institute of Standards and Technology.* The final paper production was issued in January 2012 and the periodical is now issued electronically. The Journal of Research of NIST reports NIST research and development in metrology and related fields of: physical science, engineering, applied mathematics, statistics, biotechnology, and information technology.

Exhibit 36

Department of Commerce
National Institute of Standards and Technology
AVERAGE SALARY

	2015 Estimate	2016 Estimate	2017 Estimate
Average ES salary	$177,622	$179,931	$182,810
Average scientific and professional	178,609	180,931	183,826
Average Career Path Salary	110,454	111,889	113,680
Average salary of ungraded positions	57,920	58,673	59,612

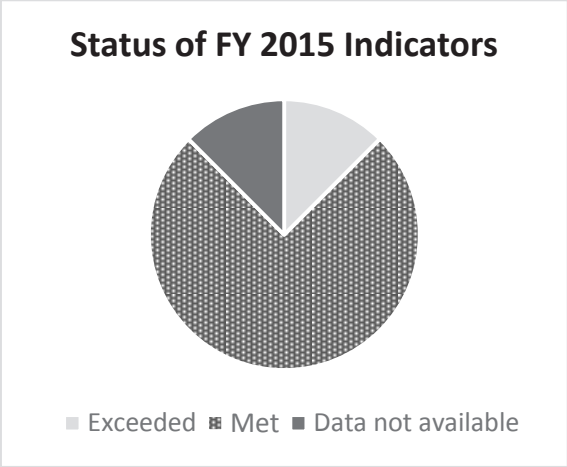
FY 2016 average salaries reflect the 1.3% payraise and FY 2017 average salaries reflect the 1.6% payraise.

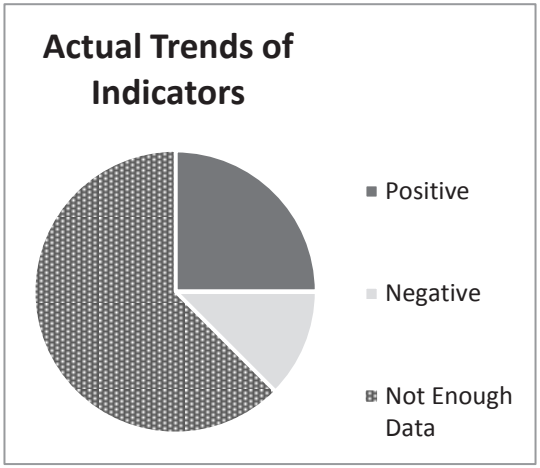
FY 2017 Performance Planning and FY 2015 Reporting Backup

National Institute of Standards and Technology

Performance Indicator Information

Summary of Performance





Summary of Indicator Performance

- Of the 9 NIST performance indicators, 1 was Exceeded, 6 were Met and 2 do not yet have data available.
- Of the 9 NIST performance indicators, 3 have trend data. Of these indicators with trend data, 2 were positive and 1 is negative.

Summary of FY 2015 Indicator Performance

Indicator	Target	Actual	Status	Trend
Dollar amount of co-investment by non-federal sources in	$0	$0		

DOC-supported NNMI institutes (Key)				
Number of businesses using NIST research facilities (Key)	225	444 (partial data)	Exceeded	Not enough data
Number of firms receiving in-depth technical assistance from MEP centers (Key)	8750	8419	Met	Positive
Percentage of MEP clients receiving in-depth technical assistance that increase their competitiveness (Key)	62%	56%	Met	Negative
Relative citation impact of NIST-authored publications (Key)	1.5	Not available	Not available	Positive
Number of critical infrastructure sectors with work products integrating the Cybersecurity Framework (Key)	12	12	Met	Not enough data
Number of Public safety communications stakeholder R&D roadmaps (Supporting)	1	1	Met	Not enough data
Number of MEP centers partnering with skills training providers (e.g., community colleges) to link manufacturing firms with skills training resources (Key)	55	54	Met	Not enough data
Milestones completed for Commerce interoperability framework	Expand CIF/CAP pilot to include additional bureaus/ agencies	Complete	Met	Not enough data

Detailed Indicator Plans and Performance

Strategic Goal 2	INNOVATION: Foster a more innovative U.S. economy—one that is better at inventing, improving, and commercializing products and technologies							
Objective 2.1	Accelerate advanced manufacturing							
Indicator	Dollar amount of co-investment by non-federal sources in DOC-supported NNMI institutes							
Category	Key							
Type	Intermediate Outcome							
Description	This indicator reflects how well the focus area of the National Network for Manufacturing Innovation (NNMI) Institutes matches a real national need and is intended to measure the extent to which the industrial partners perceive that they are receiving value from the existence of the Institute. Non-federal partners dedicate resources when they believe that there will be economic benefit. Non-federal sources include industry partners of all sizes, state and local governments, economic development entities, institutions of higher education, private organizations and individuals. Investment includes cash and in-kind resources provided.							
	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017

Target								$12M
Actual								
Status								
Trend								

Explanation (if not met in FY 2015)	Not applicable
Actions to be taken / Future Plans	None
Adjustments to targets	The FY2017 target assumes launching a competition for at least one DOC-supported NNMIs in FY2016 which would be awarded in early FY2017.
Notes	None
Information Gaps	None

Strategic Goal 2	INNOVATION: Foster a more innovative U.S. economy—one that is better at inventing, improving, and commercializing products and technologies							
Objective 2.1	Accelerate advanced manufacturing							
Indicator	Number of businesses using NIST research facilities							
Category	Key							
Type	Output							
Description	This indicator reflects the value, relevance, and usefulness of NIST research facilities to industry users. NIST research facilities are unique capabilities that can be leveraged through partnerships with businesses, especially manufacturers, to accelerate discovery and commercialization of innovative products. This indicator counts the number of Cooperative Research and Development Agreements between industry and NIST laboratories, as well as the number of industrial institutions that use the NIST user facilities (NIST Center for Neutron Research and the Center for Nanoscale Science and Technology).							
	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017
Target					215	225	275	325
Actual					514	444		
Status					Exceeded	Exceeded		
Trend	Not enough data							

Explanation (if not met in FY 2015)	Not Applicable
Actions to be taken / Future Plans	None
Adjustments to targets	FY2016 target has been increased to reflect the expanded collaborations with industry in the areas of cybersecurity and advanced communications.

Notes	FY2015 is partial data because data from the NIST Center for Neutron Research (NCNR) and the Center for Nanoscale Science and Technology (CNST) lag due to the time it takes for industry participants to publish in peer-reviewed publications. The FY 2014 actual in the FY 2016 Congressional Budget submission was an estimate. FY2014 actual has since been updated.
Information Gaps	Data may not include all instances of industry use of NIST research facilities indirectly through support of academic research.

Strategic Goal 2	INNOVATION: Foster a more innovative U.S. economy—one that is better at inventing, improving, and commercializing products and technologies							
Objective 2.1	Accelerate advanced manufacturing							
Indicator	Number of firms receiving in-depth technical assistance from MEP centers							
Category	Key							
Type	Output							
Description	Number of client firms receiving services from MEP centers where those services were substantial and essential and therefore could reasonably be assumed to have directly or entirely led to the impacts reported through the MEP client survey.							
	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017
Target					8340	8750	8986	9187
Actual			7614	8140	8353	8419		
Status					Exceeded	Met		
Trend	Positive							
Explanation (if not met in FY 2015)								
Actions to be taken / Future Plans	None							
Adjustments to targets	The multi-year recompetition of the MEP system will result in a number of MEP centers focusing on developing proposals or ramping up operations as newly awarded centers. The focus on these activities is expected to reduce the growth rate in the number of MEP clients served for FYs 2016 – 2017. Therefore, FY 2016 targets have been adjusted to reflect the impact of the recompetition across the MEP system.							
Notes	While NIST had actual information for this indicator dating back to FY2012, it was not used as an official GPRA indicator until FY 2014 and therefore targets are not set before FY 2014.							
Information Gaps	None							

Strategic Goal 2	INNOVATION: Foster a more innovative U.S. economy—one that is better at inventing, improving, and commercializing products and technologies
Objective 2.1	Accelerate advanced manufacturing
Indicator	Percentage of MEP clients receiving in-depth technical assistance that increase their competitiveness
Category	Key
Type	Outcome

Description	Percentage of MEP clients receiving in-depth technical assistance that reported increasing sales, reducing costs, or making new investments as a result of the services received.							
	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017
Target					60%	62%	63%	64%
Actual			61%	59%	58%	56%		
Status					Met	Met		
Trend	Negative							

Explanation (if not met in FY 2015)	
Actions to be taken / Future Plans	Response rate to the MEP Client Impact survey in FY15 was 70%, lower than previous years. MEP will develop strategies to improve response rate to the survey.
Adjustments to targets	The multi-year recompetition of the MEP system will result in a number of MEP centers focusing on developing proposals or ramping up operations as newly awarded centers. The focus on these activities is expected to reduce the growth rate in the number of MEP clients served and the resulting impacts reported by MEP clients for FYs 2016 – 2017. Therefore, FY 2016 targets have been adjusted to reflect the impact of the recompetition across the MEP system.
Notes	While NIST had actual information for this indicator dating back to FY2012, it was not used as an official GPRA indicator until FY2014 and therefore targets are not set before FY 2014.
Information Gaps	None

Strategic Goal 2	INNOVATION: Foster a more innovative U.S. economy—one that is better at inventing, improving, and commercializing products and technologies							
Objective 2.1	Accelerate advanced manufacturing							
Indicator	Relative citation impact of NIST-authored publications							
Category	Key							
Type	Outcome							
Description	This indicator demonstrates that NIST consistently produces useful and relevant scientific and technical publications and is outcome-oriented. The "relative citation impact" indicator is the ratio of the average number of citations per publication (citation rate) for all NIST publications in a year to the average citation rate for a large group of peer institutions in the world. Publications typically lag by a minimum of two years due to the time needed for research, writing, journal peer review, and publication processes.							
	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017
Target	1.1	1.1	1.1	1.1	1.5	1.5	1.5	1.6
Actual	1.6	1.9	1.7	2.1	2.4	*		
Status	Exceeded	Exceeded	Exceeded	Exceeded	Exceeded			
Trend	Positive							

Explanation (if not met in FY 2015)	

Actions to be taken / Future Plans	None
Adjustments to targets	None
Notes	* The FY 2015 actual for this measure will lag at least six months. Actuals for FY 2010 – FY2014 have been updated to reflect most recent data available.
Information Gaps	Due to the ever-changing nature of research and publication, and continual updating of the dataset used to generate these metrics, the actuals for any given year are subject to change.

Strategic Goal	INNOVATION: Foster a more innovative U.S. economy—one that is better at inventing, improving, and commercializing products and technologies							
Objective 2.2	Strengthen the nation's digital economy							
Indicator	Number of critical infrastructure sectors with work products integrating the Cybersecurity Framework							
Category	Key							
Type	Intermediate Outcome							
Description	This indicator demonstrates that NIST consistently produces useful and relevant cybersecurity publications and reference materials that organizations representing or participating in a diverse set of the sixteen total critical infrastructure sectors can use. The Cybersecurity Framework may be cited in professional journals; international/national/industry standards, guidelines, and practices; sector-specific federal agency guidance to industry; and commercial/government-off-the-shelf software.							
	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017
Target					10	12	13	14
Actual					9	12		
Status					Met	Met		
Trend	Not enough data							

Explanation (if not met in FY 2015)	Not applicable
Actions to be taken / Future Plans	None
Adjustments to targets	None
Notes	None
Information Gaps	None

Strategic Goal 2	INNOVATION: Foster a more innovative U.S. economy—one that is better at inventing, improving, and commercializing products and technologies
Objective 2.2	Strengthen the nation's digital economy

Indicator	Number of Public safety communications stakeholder R&D roadmaps							
Category	Supporting (non-strategic plan)							
Target	Intermediate Outcome							
Description	This indicator demonstrates that NIST consistently produces useful and relevant cybersecurity publications and reference materials that organizations representing or participating in a diverse set of the sixteen total critical infrastructure sectors can use. The Cybersecurity Framework may be cited in professional journals; international/national/industry standards, guidelines, and practices; sector-specific federal agency guidance to industry; and commercial/government-off-the-shelf software.							
	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017
Target						1	2	3
Actual						1		
Status						Met		
Trend	Not enough data							

Explanation (if not met in FY 2015)	Not Applicable
Actions to be taken / Future Plans	None
Adjustments to targets	None
Notes	None
Information Gaps	None

Strategic Goal 2	INNOVATION: Foster a more innovative U.S. economy—one that is better at inventing, improving, and commercializing products and technologies							
Objective 2.3	Catalyze innovation ecosystems							
Indicator	Number of MEP centers partnering with skills training providers (e.g., community colleges) to link manufacturing firms with skills training resources							
Category	Key							
Type	Output							
Description	This indicator reflects the number of MEP centers involved in activities supporting the development of a workforce with industry-aligned skills. MEP is working with partners throughout the national network of centers to provide the tools, services, and connections necessary to develop a workforce with industry-aligned skills							
	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017
Target					50	55	53	48
Actual					54	54		
Status					Met	Met		
Trend	Not enough data							

Explanation (if not met in FY 2015)	Not Applicable

Actions to be taken / Future Plans	None
Adjustments to targets	The multi-year recompetition of the MEP system will result in a single MEP center in each state, reducing the total number of MEP centers. The FY 2017 target represents 96% of the MEP system partnering with a workforce development organization.
Notes	MEP Centers currently partnered with a 1) workforce investment board, 2) community college, 3) technical college, 4) university, or 5) state workforce agency are included in this count.
Information Gaps	None

Strategic Goal 3	ENVIRONMENT: Help communities and businesses prepare for and prosper in a changing environment							
Objective 3.3	Strengthen the resiliency of communities and regions							
Indicator	Number of Communities Working with NIST to Pilot the *Community Resilience Planning Guide*							
Category	Supporting (Non-Strategic Plan)							
Type	Intermediate Outcome							
Description	This indicator demonstrates that NIST consistently produces useful and relevant community resilience guidance and training materials that local governments can use to develop their long-term resilience plans.							
	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017
Target							3	6
Actual								
Status								
Trend	Not enough data							

Explanation (if not met in FY 2015)	Not Applicable
Actions to be taken / Future Plans	None
Adjustments to targets	None
Notes	NIST will publish the Community Resilience Planning Guide, Version 1 in September 2015 and will revise and update the Guide in future years. NIST will publish training materials and host online user forums to support the effective use of the Community Resilience Planning Guide. The nature and level of support will depend upon the number of communities piloting the Guide. The term "community" refers to a place that is designated by geographical boundaries and functions under the jurisdiction of a governance structure, such as a town, city, or county.
Information Gaps	This indicator measures the number of communities piloting the *Guide*. Since the Community Resilience Planning Guide is freely available for download, the indicator may only capture communities that self-disclose usage of the *Guide*.

Non-Recurring Indicators

Strategic Goal 4	Maximize the positive impacts of Commerce data on society					
Objective 4.1	Deliver increasing amounts of data to governments, businesses, and the public in formats that are easier to access and use					
Indicator	Milestones completed for Commerce interoperability framework					
Description	NIST will, in collaboration with other agencies, develop an interagency reference architecture and Commerce Interoperability Framework (CIF) or Common Access Platform (CAP)					
	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Target					Complete CIF/CAP and prototype and pilot at NIST.	Expand CIF/CAP pilot to include additional bureaus/ agencies
Actual					Complete	Complete
Status					Met	Met
Trend	Not enough data					
Notes	Pilot was completed with mash-up samples of Census and USDA data					

Indicators Proposed but not Implemented

The indicators below were originally proposed and included in the current strategic plan. However, these indicators were not implemented and new indicators, better reflecting current and future activities have been proposed.

Strategic Goal 2	INNOVATION: Foster a more innovative U.S. economy—one that is better at inventing, improving, and commercializing products and technologies
Objective 2.1	Accelerate advanced manufacturing
Indicator	Number of Full-Time Equivalents (FTEs) supporting Advanced Manufacturing Technology (AMTech) consortia
Description	Measures the sustainability/growth of funded AMTech partnerships by tracking private contributions

Strategic Goal 2	INNOVATION: Foster a more innovative U.S. economy—one that is better at inventing, improving, and commercializing products and technologies
Objective 2.2	Strengthen the Nation's digital economy
Indicator	Number of government and private test-bed facilities partnering with the Center for Advanced Communications
Description	The number of partners that invest funding, facilities and/or staff to test and evaluate new advanced wireless technologies

Strategic Goal 2	INNOVATION: Foster a more innovative U.S. economy—one that is better at inventing, improving, and commercializing products and technologies
Objective 2.2	Strengthen the Nation's digital economy
Indicator	Number of government and private test-bed facilities partnering with the Center for Advanced Communications
Description	The number of partners that invest funding, facilities and/or staff to test and evaluate new advanced wireless technologies

Strategic Goal 3	ENVIRONMENT: Help communities and businesses prepare for and prosper in a changing environment
Objective 3.1	Advance the understanding and prediction of changes in the environment
Indicator	Annual number of peer-reviewed publications related to environmental understanding and prediction
Description	The annual number of peer-reviewed publications is an indicator of productivity and relevance and is tracked using online resources. Peer review is one of the important procedures used to ensure that the quality of published information meets the standards of the scientific and technical community.

Strategic Goal 3	ENVIRONMENT: Help communities and businesses prepare for and prosper in a changing environment
Objective 3.1	Advance the understanding and prediction of changes in the environment
Indicator	Number of comparative greenhouse gas emissions studies completed
Description	Scientific studies comparing top-down and bottom-up emission estimation methodologies provide the means to improve the quality of greenhouse gas emissions data

Strategic Goal 3	ENVIRONMENT: Help communities and businesses prepare for and prosper in a changing environment
Objective 3.3	Strengthen the resiliency of communities and regions
Indicator	Percentage of key milestones met for Disaster Resilience Standards Panel
Description	A series of nationwide workshops will be held to gather input for a draft disaster resilience framework. A plan will be established to develop a complete Disaster Resilience Framework that puts community – level guidelines into action.

Strategic Goal 3	ENVIRONMENT: Help communities and businesses prepare for and prosper in a changing environment
Objective 3.5	Enable U.S. businesses to adapt and prosper by developing environmental and climate informed solutions
Indicator	Number of page visits to BIRDS, a free online software tool for businesses to assess the economic and environmental tradeoffs in developing green buildings
Description	An online software tool to help stakeholders put an environmental score on a proposed building and to assess the life cycle costs associated with that building.

Resource Requirements Table

	FY 2010 Actual	FY 2011 Actual	FY 2012 Actual	FY 2013 Actual	FY 2014 Actual	FY 2015 Actual	FY 2016 Estimate	FY 2017 Base	Increase / Decrease	FY 2017 Request
Objective 2.1 Accelerate Advanced Manufacturing										
TIP	$77.2	$74.2	$4.4	1.4	1.6	.8	4.6	-	-	-
AMTech	-	-	-	3.0	12.6	11.7	-	-	-	-
MEP	126.8	129.3	130.9	118.2	122.6	144.6	151.6	130.9	11.1	142.0
NNMI	-	-	-	-	-	-	28.3	25.0	22.0	47.0
Labs	667.4	667.3	706.4	715.6	755.5	755.9	776.8	742.8	28.7	771.5
Construction and SCMMR	169.8	91.0	35.6	75.0	64.8	40.6	144.7	119.7	(24.7)	95.0
Recovery Act funds	475.6	4.4	7.0	1.4	-	-	-	-	-	-
Subtotal Funding	**1,516.8**	**966.2**	**884.3**	**914.6**	**957.1**	**953.6**	**1,106.3**	**1,018.4**	**37.1**	**1,055.5**
Direct	1,346.0	797.7	712.6	741.1	795.9	804.1	938.2	875.0	36.6	911.6
Reimbursable	170.8	168.5	171.7	173.5	161.2	149.5	168.1	143.4	.5	143.9
Total	1,516.8	966.2	884.3	914.6	957.1	953.6	1,106.3	1,018.4	37.1	1,055.5
Subtotal FTE	**2,973**	**2,990**	**2,928**	**2,893**	**2,993**	**3,045**	**3,195**	**3,201**	**28**	**3,229**

Objective 2.2 Strengthen the Nation's digital economy										
Cybersecurity Framework and Communications Technology Laboratory	-	-	16.5	21.7	35.6	65.0	74.4	69.4	2.0	71.4
Direct	-	-	16.5	21.7	34.3	58.1	67.5	62.5	2.0	64.5
Reimbursable	-	-	-		1.3	6.9	6.9	6.9	-	6.9
Total	-	-	16.5	21.7	35.6	65.0	74.4	69.4	2.0	71.4
Subtotal FTE	**-**	**-**	**6**	**18**	**40**	**111**	**122**	**125**	**4**	**129**
Objective 2.3 Catalyze Innovation ecosystems										
National Initiative for Cyber Education (NICE) and Lab to Market	-	-	-	-	4.0	9.7	10.0	10.0	1.0	11.0
Direct	-	-	-	-	4.0	9.7	10.0	10.0	1.0	11.0
Reimbursable	-	-	-	-	-	-	-	-	-	-
Total	-	-	-	-	4.0	9.7	10.0	10.0	1.0	11.0
Subtotal FTE	-	-	-	-	**1**	**6**	**13**	**13**	**-**	**13**
Objective 3.1 Advance the understanding and prediction of changes in the environment										
Greenhouse Gas and Urban Dome	8.8	9.1	9.0	8.8	11.9	13.9	13.9	13.9	-	13.9
Direct	8.8	9.1	9.0	8.8	11.9	13.9	13.9	13.9	-	13.9
Reimbursable	-	-	-	-	-	-	-	-	-	-
Total	8.8	9.1	9.0	8.8	11.9	13.9	13.9	13.9	-	13.9
Subtotal FTE	**18**	**22**	**23**	**19**	**20**	**24**	**24**	**24**	**-**	**24**

Objective 3.2 Strengthen the resiliency of communities and regions										
Disaster Resilience	4.2	4.3	7.2	7.1	5.7	8.4	18.5	18.5	-	18.5
Direct	4.2	4.3	7.2	7.1	5.6	8.4	18.5	18.5	-	18.5
Reimbursable	-	-	-	-	0.1	-	-	-	-	-
Total	4.2	4.3	7.2	7.1	5.7	8.4	18.5	18.5	-	18.5
Subtotal FTE	**8**	**9**	**16**	**12**	**16**	**16**	**29**	**33**	**-**	**33**
Total Funding	**1,529.8**	**979.6**	**917.0**	**952.2**	**1,014.3**	**1,050.6**	**1,223.1**	**1,130.2**	**40.1**	**1,170.3**
Direct	1,359.0	811.1	745.3	778.7	851.7	894.2	1,048.1	979.9	39.6	1,019.5
Reimbursable	170.8	168.5	171.7	173.5	162.6	156.4	175.0	150.3	.5	150.8
Total	1,529.8	979.6	917.0	952.2	1,014.3	1,050.6	1,223.1	1,130.2	40.1	1,170.3
Total FTE	**2,999**	**3,021**	**2,973**	**2,942**	**3,070**	**3,202**	**3,383**	**3,396**	**32**	**3,428**

* Dollars reflect obligations for all fund sources and exclude Public Safety Communications Research Fund and National Network for Manufacturing Innovation (mandatory appropriations).

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National Technical Information
Service

DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL INFORMATION SERVICE
NTIS Revolving Fund
Budget Estimates, Fiscal Year 2017
President's Submission

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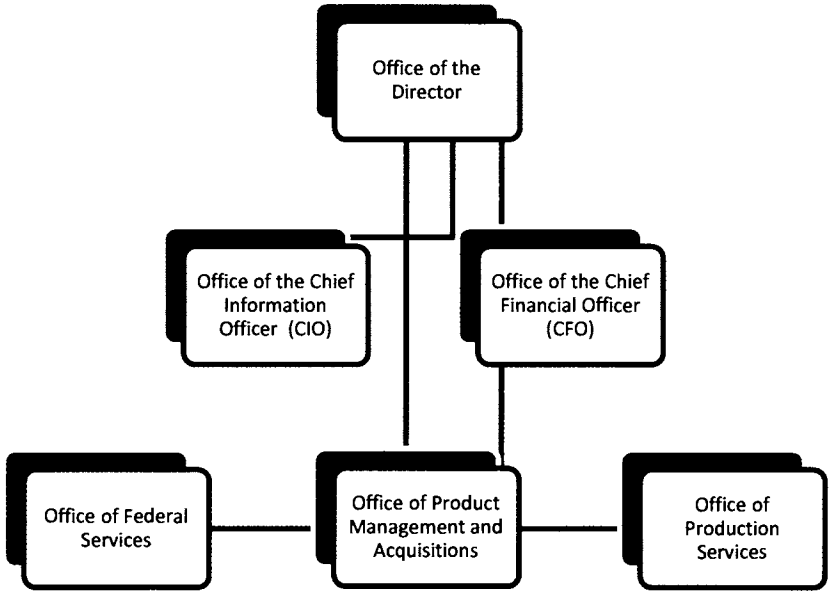
U.S Department of Commerce
National Technical Information Service



Department Of Commerce
National Technical Information Service
NTIS Revolving Fund
Budget Estimates, Fiscal Year 2017
President's Submission

General Statement

Goals of the Program

The National Technical Information Service (NTIS) promotes the data priorities of the Department of Commerce (DOC) and other federal agencies, including open access, open data, providing information and data services to the public, industry, and other federal agencies in ways that enable American innovation and economic growth. NTIS serves as a center of excellence that delivers trusted data networks through agile partnerships with the private sector which enable new and improved data products and services.

Statement of Objectives

NTIS supports the entire data delivery pipeline for creating unique platforms to access, analyze, and use data; combining data in new ways to enable innovative products and services; and delivering better data services to businesses, communities, and citizens. NTIS provides services using modern data science, engineering, and best practices which are essential to rapidly executing projects requiring high levels of innovation and creativity. NTIS is a self-supporting agency without federal discretionary appropriations and recovers its operating costs from fees and the use of its Public Enterprise Revolving Fund.

NTIS provides data services within four key elements:

- Data Discovery and Usability (e.g., data cataloging and inventories, data capture and storage, search engine optimization, interactive query management, customer analytics, user experience design of data portals, usability testing, user analytics).
- Data Interoperability and Standards (e.g., user interfaces for data portals, data cleansing and standards, metadata practices, developer platforms with suite of application program interface tools).
- Data Analytics and Forecasting (e.g., comparative/predictive data analytics, forecasting, statistical methods, computer science and machine learning methods, geospatial analysis, data visualization).
- Data Infrastructure and Security (e.g., data delivery services for access anytime, anywhere; enterprise data management; data delivery business models; software development life cycle; cybersecurity; cloud-based data solutions; assistive technologies; data collection services).

NTIS leverages its unique capabilities and authorities to partner with the private sector to rapidly execute projects requiring the use of modern data science, engineering, and best practices. Critical to success of these projects is the ability to use advanced software development processes, specifically:

- Agile and collaborative development process to support frequent software releases and

risk reduction;
- DevOps process to tightly integrate software development with quality assurance, deployment, and operations while also supporting frequent releases and risk reduction; and,
- Life cycle approach to software development (plan, code, build, test, release, deploy, and operate).

NTIS services include a permanent repository and clearinghouse for scientific, technical, engineering, and business information which includes more than three million publications covering more than 350 subject areas. Today, NTIS receives federal agency reports electronically, attaches robust metadata to these reports and ensures that the documents remain available to the public even if individual agencies remove them from their websites. NTIS's online database also presents this metadata and the full text of reports in a form that enables access across the internet. As a result, scientists, engineers, and other customers looking for federal reports and data get much better results from the search engines than would be possible without NTIS efforts. In addition, NTIS is often the only current source for many reports issued prior to 1995. NTIS received these reports from federal agencies in paper copy and has archived them on microfiche. A recent Government Accountability Office report found that in some subject areas up to 45 percent of the collection of three million publications on more than 350 subjects is exclusively available from NTIS.

As technology has evolved, projects related to online data and services have generated an increasing share of the agency's operating revenues. In June 2015, following a rigorous review of NTIS operations, the Secretary of Commerce set a new strategic focus for NTIS in alignment with the DOC strategic goal to expand access to DOC and the broader federal data resources, with an emphasis on data concerning the nation's economy, population, and environment. Numerous recent studies also predict that data from different sectors of the economy, including the rapidly growing "Internet-of-Things", could generate trillions of dollars in benefits to the U.S. alone.

NTIS now strongly supports the Department's commitment to make data easier for business, government, taxpayers, and communities to access, analyze, and use federal data assets. NTIS will evolve, and its service portfolio will continue to grow by supporting the entire data delivery pipeline with a focus on increasing access to data, combining data in new value-added ways, and delivering improved services and products.

The Department of Commerce has established an Oversight Board to guide and support the evolution of NTIS—consistent with its existing authorities—toward a focus on Department and federal data priorities, including open access and open data, and transition away from services not aligned with the data mission. This effort includes assessing and realigning the portfolio of NTIS projects to focus on the data mission; and assessing and strengthening stewardship of the joint venture process and criteria.

Summary of Performance and Resources

NTIS' objectives are to (a) create unique data platforms that make it easier for the public, industry, and other federal agencies to access, analyze, and use data; (b) combine data in new ways to enable the delivery of innovative products and services; and (c) deliver better data services to businesses, communities, and citizens. These objectives are focused on supporting Department and federal data priorities, including open access and open data. This work requires collaborating with federal agencies, partnering with the private sector, delivering modern information and data services, and disseminating federally-funded scientific, technical and related information. NTIS will meet its objectives in the most cost-effective and efficient manner possible while ensuring strong governance and stewardship of its unique mission and authorities.

NTIS released the Public Access National Technical Reports Library (NTRL) permitting the American public free access to the electronic scientific and technical reports in its repository, which collects and catalogues approximately 450,000 scientific and technical reports annually that are added to its permanent collection.

NTIS continues to make substantial progress in improving its service to the public by establishing and maintaining data programs that assist other federal agencies in effectively disseminating information to the American public. A representative set of national data programs that NTIS will continue to provide to the American public includes: NTIS Database; Social Security Administration (SSA) Limited Access Death Master File (DMF); and, Drug Enforcement Agency (DEA) Drug Registry File.

NTIS plans to obligate $145,500,000 of earned revenue in FY 2017.

(Dollar amounts in thousands)

	FY 2015	FY 2016	FY 2017
National Technical Information Service:			
Reimbursement from offsetting collections:			
Information clearinghouse program	$175,202	$170,000	$145,500
Total, NTIS	$175,202	$170,000	$145,500

Note: Reimbursable Budget Authority, receipt and obligation data are estimates. Actuals will vary depending on products and services sold.

Department of Commerce
National Technical Information Service
NTIS Revolving Fund
SUMMARY OF RESOURCE REQUIREMENTS
(Dollar amounts in thousands)

	Positions	FTE	Budget Authority	Direct Obligations
President's Budget, 2017	0	0	0	0
Plus 2017 Adjustments to base:	0	0	0	0
less: Obligations from prior years	0	0	0	0
2017 Base	0	0	0	0
Plus: 2017 Program Changes	0	0	0	0
2017 Estimate	0	0	0	0

Comparison by activity/subactivity:		2015 Actual		2016 President's Budget		2017 Base		2017 Estimate		Increase/(Decrease over 2017 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount	Personnel	Amount
National Technical Information Service:											
Organization, Preservation and Public	Pos./BA	0	0	0	0	0	0	0	0	0	0
Access to Technical Information	FTE/Obl.	0	0	0	0	0	0	0	0	0	0
TOTALS	Pos./BA	0	0	0	0	0	0	0	0	0	0
	FTE/Obl.	0	0	0	0	0	0	0	0	0	0
Adjustments for:											
Recoveries		0	0	0	0	0	0	0	0	0	0
Unobligated balance, start of year		0	0	0	0	0	0	0	0	0	0
Unobligated balance transferred		0	0	0	0	0	0	0	0	0	0
Unobligated balance, end of year		0	0	0	0	0	0	0	0	0	0
Unobligated balance expiring		0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Financing from transfers:		0	0	0	0	0	0	0	0	0	0
Transfer from other accounts (-)		0	0	0	0	0	0	0	0	0	0
Transfer to other accounts (+)		0	0	0	0	0	0	0	0	0	0
Appropriation		0	0	0	0	0	0	0	0	0	0

Department of Commerce
National Technical Information Service
NTIS Revolving Fund
SUMMARY OF REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: National Technical Information Service
Subactivity: Information Clearinghouse Program

Line Item	2015 Actual FTE	2015 Actual Amount	2016 President's Enacted FTE	2016 President's Enacted Amount	2017 Base FTE	2017 Base Amount	2017 Estimate FTE	2017 Estimate Amount	Increase/ (Decrease) over 2017 Base FTE	Increase/ (Decrease) over 2017 Base Amount
National Technical Information Service: Information Clearinghouse Program	99	$175,202	150	$170,000	150	$145,500	150	$145,500	0	0
Total	99	$175,202	150	$170,000	150	$145,500	150	$145,500	0	0

Department of Commerce
National Technical Information Service
NTIS Revolving Fund
SUMMARY OF FINANCING
(Dollar amounts in thousands)

	2015 Actual	2016 Currently Available	2017 Base	2017 Estimate	Increase/ (Decrease) Over 2017 Base
Total Obligations	$175,202	$169,569	$145,500	$145,500	0
Offsetting collections from:					
Federal funds	(153,973)	(156,200)	(133,500)	(108,200)	0
Trust funds	0	0	0	0	0
Non-Federal sources	(8,061)	(13,800)	(12,000)	(13,800)	0
Recoveries	0	0	0	0	0
Unobligated balance, start of year	(14,569)	(9,486)	(9,486)	(9,486)	0
Unobligated balance transferred	0	0	0	0	0
Unobligated balance, end of year	(9,486)	0	0	0	0
Budget Authority	0	0	0	0	0
Financing:					
Transfer from other accounts (-)	0	0	0	0	0
Transfer to other accounts (+)	0	0	0	0	0
Appropriation	0	0	0	0	0

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Department Of Commerce National
Technical Information Service NTIS
Revolving Fund
JUSTIFICATION OF PROGRAM AND PERFORMANCE

APPROPRIATION ACCOUNT: NTIS Revolving Fund

BUDGET ACTIVITY: Organization, Preservation and Public Access to Technical Information

For FY 2017, the National Technical Information Service plans to continue to operate on a self-supporting reimbursable basis, which will include estimated obligations of $145,500,000 and 150 FTE.

BASE JUSTIFICATION FOR FY 2017:

NTIS' basic authority is to operate a permanent clearinghouse of scientific and technical information, codified as chapter 23 of Title 15 of the United States Code (15 U.S.C. 1151-1157). This chapter also established NTIS' authority to charge fees for its products and services and to recover all costs through such fees "to the extent feasible".

All activities are funded through the NTIS Revolving Fund, without direct appropriation.

Significant Adjustments-to-Base (ATBs):

- None

Department Of Commerce National
Technical Information Service NTIS
Revolving Fund
JUSTIFICATION OF PROGRAM AND PERFORMANCE

PROGRAM CHANGES FOR FY 2017:

None

Deliverables:

Performance Goals and Measurement Data

Performance Measure: Number of updated items available	FY 2015 Act.	FY 2016 Target	FY 2017 Target	FY 2018 Target	FY 2019 Target	FY 2020 Target	FY 2021 Target
Total	519,091	440,750	451,769	463,063	474,640	486,506	498,668

Description: The number of information items available to the public includes scientific, technical, and engineering information products added to the permanent collection, as well as items made available through online electronic subscriptions. In FY2014, World News Connection (WNC) was discontinued and this measure was revised.

Performance Measure: Number of information products disseminated (annual)	FY 2015 Act.	FY 2016 Target	FY 2017 Target	FY 2018 Target	FY 2019 Target	FY 2020 Target	FY 2021 Target
Total	48.8M	53.9M	54.9M	55.9M	56.9M	58.0M	59.1M

Description: This measure represents the volume of information products disseminated to the public and includes compact discs, diskettes, tapes, online subscriptions, web site pages, as well as the traditional paper products.

Performance Measure: Customer Satisfaction	FY 2015 Act.	FY 2016 Target	FY 2017 Target	FY 2018 Target	FY 2019 Target	FY 2020 Target	FY 2021 Target
Total	97.5%	95%-98%	95%-98%	95%-98%	95%-98%	95%-98%	95%-98%

Description: This measure represents the percentage of NTIS customers that are satisfied with the quality of their order, the ease of order placement, and they timely processing of that order. NTIS' continual efforts to maintain and possibly improve this very high rate of customer satisfaction are essential to the success of NTIS' performance and mission to collect and disseminate scientific and business-related information.

Department of Commerce
National Technical Information Service
NTIS Revolving Fund - Reimbursable Obligations
SUMMARY OF REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

	Object Class	2015 Actual	2016 Presid Budget	2017 Base	2017 Estimate	Increase/ (Decrease) Over2017 Base
11.1	Full-time permanent (Compensation)	$ 9,215	$ 13,750	$ 13,750	$ 13,750	0
11.3	Other than full-time permanent	150	150	150	$ 150	0
11.5	Other personnel compensation	95	116	116	$ 116	0
11.8	Special personnel services payments	0	0	0	0	0
11.9	Total personnel compensation	9,460	14,016	14,016	14,016	0
12.1	Civilian personnel benefits	3,048	4,725	4,725	$ 4,725	0
13	Benefits for former personnel	0	0	0	0	0
21	Travel and transportation of persons	169	200	200	$ 200	0
22	Transportation of things	1,323	3,250	3,250	$ 3.250	0
23.1	Rental payments to GSA	1,667	1,950	1,950	$ 1,950	0
23.2	Rental payments to others	164	1,000	1,000	$ 1,000	0
23.3	Communications, utilities and miscellaneous charges	849	1,800	1,800	$ 1,800	0
24	Printing and reproduction	(127)	4,000	4,000	$ 4.000	0
25.1	Consulting services	400	100	100	$ 100	0
25.2	Other services	151,175	131,959	107,459	$ 107,459	0
25.3	Purchases of goods and services from Government accounts	2,794	1,500	1,500	$ 1,500	0
25.4	Operation of GOCOs	0	0	0	0	0
25.5	Research and development contracts	0	0	0	0	0
25.7	Operation and Maintenance of Equipment	300	500	500	$ 500	0
26	Supplies and materials	1,503	3.000	3,000	$ 3,000	0
31	Equipment	2,477	2,000	2,000	$ 2,000	0

Department of Commerce
National Technical Information Service
NTIS Revolving Fund - Reimbursable Obligations
SUMMARY OF REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

	Object Class	2015 Actual	2016 Enacted	2017 Base	2017 Estimate	Increase/ (Decrease) over 2017 Base
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
44	Refunds	0	0	0	0	0
99	Total Obligations	175,202	170,000	145,500	145,500	0
	Earned Revenue/Reimbursable Obligations	175,202	170,000	145,500	145,500	0
	Total Obligations	175,202	170,000	145,500	145,000	0
Personnel Data						
Full-Time equivalent Employment:						
	Full-time permanent	98	145	145	145	0
	Other than full-time permanent	1	5	5	5	0
	Total	99	150	150	150	0
Authorized Positions:						
	Full-time permanent	190	190	190	190	0
	Other than full-time permanent	10	10	10	10	0
	Total	200	200	200	200	0

Department of Commerce
National Technical Information Service
NTIS Revolving Fund
CONSULTING AND RELATED SERVICES
(Obligations in thousands)

	2015 Actual	2016 Estimate	2017 Estimate
Consulting Services	$400	$100	$500
Management and professional services	0	0	0
Special studies and analysis	0	0	0
Management and Support Services for research and development	0	0	0
Total	$400	$100	$500

Department of Commerce
National Technical Information Service
NTIS Revolving Fund
PERIODICALS, PAMPHLETS, AND AUDIOVISUSAL PRODUCTS
(Obligations in thousands)

	2015 Actual	2016 Estimate	2017 Estimate
Periodicals	$2	$2	$2
Pamphlets	0	0	0
Audiovisuals	0	0	0
Total	$2	$2	$2

Department of Commerce
National Technical Information Service
NTIS Revolving Fund
AVERAGE GRADE AND SALARIES
(Obligations in thousands)

	2015 Actual	2016 Estimate	2017 Estimate
Average GS/GM Grade.....	12	12.8	12.8
Average GS/GM Salary	$93,837	$94,203	$94,203

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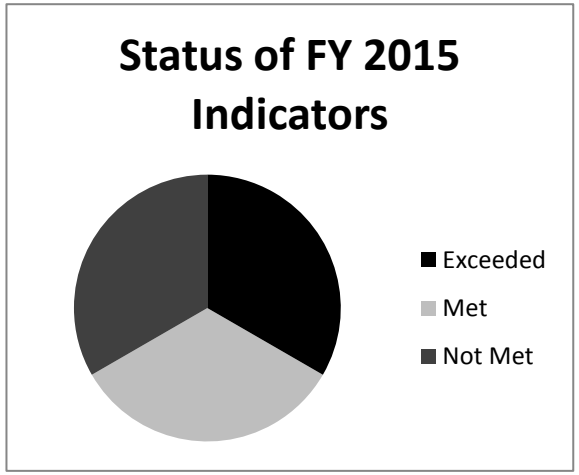
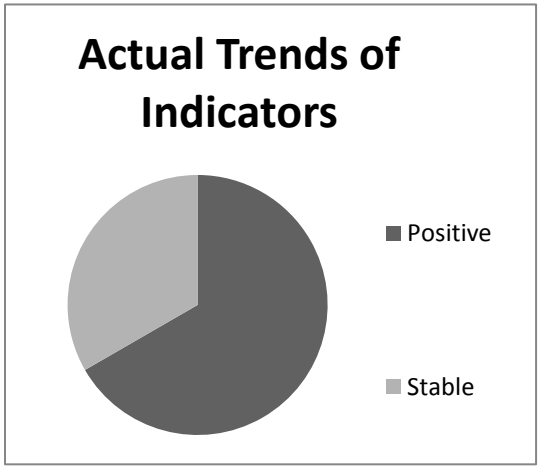
FY 2017 Performance Planning and FY 2015 Reporting Backup

(National Technical Information Service)

Summary of Performance

NTIS exceeded the target for one of three indicators, met the target for one and didn't meet the target for the third. All three indicators had trends with two having positive trends and one having a stable trend.





Summary of FY 2015 Indicator Performance

Strategic Goal 4: DATA – Maximize the positive impacts of Commerce data on society

Objective 4.1: Deliver increasing amounts of data to governments, businesses, and the public in formats that are easier to access and use

Indicator	Target	Actual	Status	Trend
Number of Updated Items Available	430,000	519,091	Exceeded	Positive
Number of Information Products Disseminated (Annual)	52,900,000	48,794,579	Not Met	Positive
Customer Satisfaction	95-98%	97.5%	Met	Stable

Detailed Indicator Plans and Performance

Indicator	Number of Updated Items Available							
Category	Supporting (Non-Strategic Plan)							
Type	Output							
Description	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. In FY2014, World New Connection (WNC) was discontinued and this measure was revised.							
	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017
Target	765,000	825,000	875,000	892,500	910,350	430,000	440,750	451,769
Actual	969,473	836,579	978,871	987,866	648,299	519,091		
Status	Exceeded	Exceeded	Exceeded	Exceeded	Not Met	Exceeded		
Trend	Positive							
Actions to be taken / Future Plans	Will need to revise this measure in FY2016. Federal Research in Progress (FEDRIP) is most of this measure and is being discontinued.							
Adjustments to targets	May need to revise targets in FY2016. FEDRIP is most of this measure and is being discontinued.							
Notes								
Information Gaps	None							

Indicator	Number of Information Products Disseminated (Annual)							
Category	Supporting(Non-Strategic Plan)							
Type	Output							
Description	This measure represents information disseminated and includes compact disks, diskettes, tapes, online subscriptions, electronic document downloads, web site pages, as well as traditional paper products.							
	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017
Target	33,000,000	47,800,000	48,878,000	50,875,560	51,893,071	52,910,932	53,900,000	54,900,000
Actual	50,333,206	48,958,993	54,592,481	68,938,571	51,901,102	48,794,579		
Status	Exceeded	Exceeded	Exceeded	Exceeded	Exceeded	Not Met		
Trend	Positive							
Explanation (if not	Not met due to the following products being discontinued in FY2015: 1) BIS Export Administration Regulations (EAR) Papercopy							

met in FY 2015)	and CD ROM; 2) National Correct Coding Manual (NCCM) and associated product line; and 3) Distribution services for USDA Supplemental Nutrition Assistance Program (SNAP) and USDA Food and Nutrition Service (FNS).
Actions to be taken / Future Plans	Will need to revise this measure as NTIS evolves with the new Data Mission
Adjustments to targets	May need to revise targets as NTIS evolves with the new Data Mission State
Notes	
Information Gaps	None

Indicator	Customer Satisfaction							
Category	Supporting (Non-Strategic Plan)							
Type	Customer Service							
Description	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 fulfillment of that order. NTIS' continual efforts to maintain and possibly improve this very high rate of customer satisfaction are essential to the success of NTIS' performance and mission to collect and disseminate scientific and business-related information.							
	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017
Target	95-98%	95-98%	95-98%	95-98%	95-98%	95-98%	95-98%	95-98%
Actual	98%	99.5%	98.4%	98.5%	98.3%	97.5%		
Status	Met	Met	Met	Met	Met	Met		
Trend	Targets have remained stable. Actuals have risen slightly each year.							
Actions to be taken / Future Plans	None							
Adjustments to targets	None							
Notes	None							
Information Gaps	None							

Non-Recurring Indicators

None

Resource Requirements Table

	FY 2010 Actual	FY 2011 Actual	FY 2012 Actual	FY 2013 Actual	FY 2014 Actual	FY 2015 Est / Actual	FY 2016 Estimate	FY 2017 Base	Increase / Decrease	FY 2017 Request
Goal 4: DATA – Maximize the positive impacts of Commerce data on society										
Objective 4.1: Deliver increasing amounts of data to governments, businesses, and the public in formats that are easier to access and use										
Total Funding										
Direct										
Reimbursable	$42,000	$65,000	$65,500	$66,000	$66,500	$169,569	$170,000	$145,500	0	$145,500
Total										
Total FTE	150	150	150	150	150	150	150	150	0	150