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The National Institute of Standards and Technology (NIST), a laboratory of the Department of Commerce, is mandated to provide technical services to facilitate the competitiveness of U.S. industry. NIST is directed to offer support to the private sector for the development of precompetitive generic technologies and the diffusion of government-developed innovation to users in all segments of the American economy. Laboratory research is to provide measurement, calibration, and quality assurance techniques that underpin U.S. commerce, technological progress, improved product reliability, manufacturing processes, and public safety.

President Trump requested $725.0 million in discretionary funding for NIST in FY2018. In March 2018, the Consolidated Appropriations Act, 2018 (P.L. 115-141) was enacted, providing $1,198.5 million in funding for NIST for FY2018. President Trump requested $629.1 million in discretionary funding for NIST in FY2019, $569.4 million (47.5%) below the FY2018 enacted level. The House-reported appropriations level for FY2019 is $985.0 million; the Senate reported level is $1,037.5 million. NIST is currently funded under the Continuing Appropriations Act, 2019 (P.L. 115-245), Division C of the Department of Defense and Labor, Health and Human Services, and Education Appropriations Act, 2019 and Continuing Appropriations Act, 2019. Funding under this act is provided through December 7, 2018.

Concerns about the adequacy of federal funding for physical science and engineering research led to efforts by successive Presidents and Congresses to double funding for the NIST laboratory and construction accounts, together with the National Science Foundation and the Department of Energy Office of Science. However, appropriations did not keep pace with authorization levels or presidential requests. In addition, the appropriations authorizations for the accounts targeted for doubling lapsed at the end of FY2013. Appropriations for the targeted NIST accounts increased by 42.3% from FY2006 to FY2016.

Funding for NIST extramural programs directed toward increased private sector commercialization has been a topic of congressional debate. Some Members of Congress have expressed skepticism over a “technology policy” based on providing federal funds to industry for development of precompetitive generic technologies. This approach, coupled with pressures to balance the federal budget, led to significant reductions in funding for NIST. The Advanced Technology Program (ATP) and the Manufacturing Extension Partnership (MEP), which accounted for over 50% of the FY1995 NIST budget, were subsequently proposed for elimination. In 2007, ATP was terminated and replaced by the Technology Innovation Program (TIP). TIP was subsequently defunded in the FY2012 appropriations legislation. President Trump has proposed the elimination of funding for the MEP program in FY2019.

In December 2014, Congress enacted the Revitalize American Manufacturing and Innovation Act of 2014 (Title VII of Division B of P.L. 113-235), establishing a Network for Manufacturing Innovation (also referred to as the National Network for Manufacturing Innovation or NNMI). The explanatory statement accompanying the Consolidated Appropriations Act, 2016 (P.L. 114-113) directed NIST to use an open competition to select the technological focus areas of industry-driven manufacturing institutes. Upon completion of its first competition, NIST announced its selection of the National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL) in December 2016. Congress appropriated $15 million in FY2018 funding for NIST to continue its support for NIIMBL and to coordinate network activities. In total, 14 NNMI institutes have been established by the Department of Defense (8), Department of Energy (5), and Department of Commerce (1).

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Mission

The U.S. Department of Commerce's National Institute of Standards and Technology (NIST) is the "lead national laboratory for providing the measurements, calibrations, and quality assurance techniques which underpin United States commerce, technological progress, improved product reliability and manufacturing processes, and public safety."[1]

By statute, NIST is "to assist private sector initiatives to capitalize on advanced technology; to advance, through cooperative efforts among industries, universities, and government laboratories, promising research and development projects, which can be optimized by the private sector for commercial and industrial applications; and to promote shared risks, accelerated development, and pooling of skills which will be necessary to strengthen America's manufacturing industries."[2]

NIST conducts leading-edge research in its seven research laboratories located in facilities in Gaithersburg, MD, and Boulder, CO.[3] NIST employs approximately 3,000 scientists, engineers, technicians, and support personnel, and hosts about 3,500 guest researchers and associates from academia, industry, and other government agencies, who collaborate with NIST staff and access user facilities. Research is focused on measurement, standards, test methods, and basic "infrastructural technologies" that enable development of advanced technologies. Infrastructural technologies assist industry in characterizing new materials, monitoring production processes, and ensuring the quality of new product lines. Cooperative research with industry to overcome technical barriers to commercialization of emerging technologies is a major component of NIST's work.

In addition, NIST manages extramural programs such as the Hollings Manufacturing Extension Partnership (MEP) program and the Network for Manufacturing Innovation (NMI, also referred to as Manufacturing USA). Several other extramural programs previously conducted by NIST have been eliminated or integrated into other NIST activities. These programs are discussed in the next section.

History and Selected Statutory Authorities

Unlike most federal laboratories, NIST has a mission specified by statute (15 U.S.C. 271-282a), has a separate authorization and appropriation, and is headed by a Senate-confirmed presidential appointee (the Under Secretary of Commerce for Technology and Standards). NIST was originally created by the NBS Organic Act of 1901 (P.L. 56-177) as the National Bureau of Standards (NBS), at a time when the first centralized industrial labs were being established.[4]

Under the act, NBS was charged with working on "the solution of problems which arise in connection with standards" and to engage in the "determination of physical constants and the properties of materials, when such data are of great importance to scientific or manufacturing interests and are not to be obtained of sufficient accuracy elsewhere." These objectives remain central to NIST's laboratory work today.

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[1] §5111, Omnibus Trade and Competitiveness Act of 1988 (P.L. 100-418).

[2] Ibid.

[3] The seven laboratories are the Materials Measurement Laboratory, Physical Measurement Laboratory, Engineering Laboratory, Information Technology Laboratory, Communications Technology Laboratory, Center for Nanoscale Science and Technology, and Center for Neutron Research.

[4] General Electric Research Laboratory, widely recognized as the first industrial research facility, was established in 1900 in Schenectady, NY.

Malcolm Baldrige National Quality Improvement Act of 1987

In 1987, the Malcolm Baldrige National Quality Improvement Act of 1987 (P.L. 100-107) established the Malcolm Baldrige National Quality Award under the management of NBS.[5] The act directs the President or the Secretary of Commerce to "periodically make the award to companies and other organizations which in the judgment of the President or the Secretary have substantially benefited the economic or social well-being of the United States through improvements in the quality of their goods or services resulting from the effective practice of quality management, and which as a consequence are deserving of special recognition."[6]

Omnibus Trade and Competitiveness Act of 1988

The following year, amid widespread concerns about the state of U.S. industrial competitiveness, the Omnibus Trade and Competitiveness Act of 1988 (P.L. 100-418) significantly expanded the role of NIST as the "lead national laboratory for providing the measurements, calibrations, and quality assurance techniques which underpin United States commerce, technological progress, improved product reliability and manufacturing processes, and public safety" by "moderniz[ing] and restructur[ing] that agency to augment its unique ability to enhance the competitiveness of American industry."[7] The act also changed the name from NBS to the National Institute of Standards and Technology to reflect its expanded mission. In addition to its long-standing work in standards and metrology,[8] NIST was directed to offer support to the private sector for the development of precompetitive generic technologies and the diffusion of government-developed innovation to users in all segments of the U.S. economy. Among its provisions, the act established the Advanced Technology Program (ATP), and a program now known as the Hollings Manufacturing Extension Partnership program.

Hollings Manufacturing Extension Partnership Program

The MEP is a program of regional centers that assist smaller, U.S.-based manufacturing companies in identifying and adopting new technologies. Operating under the auspices of NIST, centers in all 50 states and Puerto Rico provide technical and managerial assistance to firms. Federal funding for the centers is matched by nonfederal sources.[9]

Advanced Technology Program

The Advanced Technology Program was designed "to serve as a focal point for cooperation between the public and private sectors in the development of industrial technology," according to the report accompanying the bill, and to help solve "problems of concern to large segments of an industry." Placed within the National Institute of Standards and Technology in recognition of the laboratory's ongoing relationship with industry, ATP provided seed funding to single companies or to industry-led consortia of universities, businesses, and/or government laboratories for development of generic (broad-based), precompetitive technologies that have many applications across industries. Awards, based on technical and business merit, were for high-risk work past the basic research stage but not yet ready for commercialization. Market potential was an important

[5] The program is currently managed under NIST's Baldrige Performance Excellence Program.

[6] Malcolm Baldrige National Quality Improvement Act of 1987 (P.L. 100-107).

[7] §5111, P.L. 100-107.

[8] Metrology is the science of measurement.

[9] For additional information on the Hollings Manufacturing Extension Partnership program, see CRS Report R44308, *The Manufacturing Extension Partnership Program*, by John F. Sargent Jr.

consideration in project selection. Scientific and technical review generally was performed by federal and academic experts. Business plan assessments were made by individuals from the private sector.

America COMPETES Act/America COMPETES Reauthorization Act of 2010

The America COMPETES Act (P.L. 110-69) and the America COMPETES Reauthorization Act of 2010 (P.L. 111-358) authorized NIST appropriations and several programs and activities.

Technology Innovation Program

In 2007, the America COMPETES Act replaced ATP with a new program, the Technology Innovation Program (TIP). While similar to ATP in the promotion of R&D expected to be of broad-based economic benefit to the nation, TIP appeared to have been structured to avoid what was seen as government funding of large firms that opponents argued did not necessarily need federal support for research. The committee report to accompany H.R. 1868, part of which was incorporated into P.L. 110-69, stated that TIP replaced ATP in consideration of a changing global innovation environment focusing on small and medium-sized companies. The design of the program also "acknowledges the important role universities play in the innovation cycle by allowing universities to fully participate in the program."[10] Appropriations for TIP were provided from FY2008 to FY2011; no appropriations have been provided for TIP since FY2011.

NIST Doubling Effort

The America COMPETES Act authorized appropriations for NIST accounts for FY2008-FY2010, and the America COMPETES Reauthorization Act of 2010 authorized appropriations for NIST accounts for FY2011-FY2013. The authorization levels for NIST were part of a larger effort to double funding for selected accounts—all of the National Science Foundation, the Department of Energy Office of Science, and the NIST laboratory and construction accounts—that support physical sciences and engineering research.[11] Congress's appropriations fell short of the authorizations in these acts, and President Obama's FY2017 request did not refer to the doubling goal. President Trump's FY2018 and FY2019 budgets do not include any reference to the doubling effort.

Middle Class Tax Relief and Job Creation Act of 2012

As part of the Public Safety Trust Fund provided for in the Middle Class Tax Relief and Job Creation Act of 2012 (P.L. 112-96), a share of spectrum auction proceeds are to be made available to NIST as part of a Wireless Innovation (WIN) Fund to help develop cutting-edge wireless technologies for public safety users. WIN funds are to be used for developing leading-edge wireless technologies for public safety users, including helping 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

[10] For more information on the Technology Innovation Program, see CRS Report RS22815, *The Technology Innovation Program*, by Wendy H. Schacht (available to congressional clients upon request to CRS).

[11] For more information on the doubling effort, see CRS Report R41951, *An Analysis of Efforts to Double Federal Funding for Physical Sciences and Engineering Research*, by John F. Sargent Jr.

interoperable nationwide broadband network for first responders. The spectrum auction provided NIST with approximately $285.0 million for this purpose;[12] efforts began in FY2015 and are continuing in FY2018.

Revitalize American Manufacturing and Innovation Act of 2014

In his FY2013 budget, President Obama proposed the creation of a National Network for Manufacturing Innovation (NNMI) to help accelerate innovation by investing in industrially relevant manufacturing technologies with broad applications, and to support manufacturing technology commercialization by bridging the gap between the laboratory and the market. Congress did not act on this request or a subsequent one made in President Obama's FY2014 request. President Obama renewed the request in his FY2015 budget. In December 2014, Congress enacted the Revitalize American Manufacturing and Innovation Act of 2014 (RAMI Act) as Title VII of Division B of the Consolidated and Further Continuing Appropriations Act, 2015 (P.L. 113-235), establishing a Network for Manufacturing Innovation (NMI), largely similar to President Obama's concept for the NNMI. As specified in the act, the purpose of the NMI is to improve the competitiveness of U.S. manufacturing and to increase the production of goods manufactured predominantly within the United States; to stimulate U.S. leadership in advanced manufacturing research, innovation, and technology; to facilitate the transition of innovative technologies into scalable, cost-effective, and high-performing manufacturing capabilities; to facilitate access by manufacturing enterprises to capital-intensive infrastructure, including high-performance electronics and computing, and the supply chains that enable these technologies; to accelerate the development of an advanced manufacturing workforce; to facilitate peer exchange and the documentation of best practices in addressing advanced manufacturing challenges; to leverage nonfederal sources of support to promote a stable and sustainable business model without the need for long-term federal funding; and to create and preserve jobs.[13]

The act did not appropriate funds specifically for the NMI program but instead authorized NIST to spend up to $5.0 million of its appropriated funds each year from FY2015 to FY2024 to carry out the program. In addition, the act authorizes the Department of Energy (DOE) to transfer up to a total of $250.0 million to NIST between FY2015 and FY2024 to carry out the program. The act also allows existing manufacturing centers to be classified as centers for manufacturing innovation, making them eligible to participate in the network. President Obama initiated the establishment of several such centers prior to enactment of the RAMI Act under the general statutory authority of several agencies, including the Department of Defense and Department of Energy.

While no funding has been transferred from DOE to NIST as authorized by the RAMI Act, in December 2015, the Consolidated Appropriations Act, 2016 (P.L. 114-113) provided specific funding, for the first time, for the establishment and coordination of institutes under the provisions of the RAMI Act. The act provides NIST with $25.0 million for FY2016 for the NNMI, to include funding for establishment of institutes and up to $5.0 million for coordination activities.[14] The explanatory statement accompanying the act directs NIST to "follow the

[12] Department of Commerce, *The Department of Commerce Budget in Brief: Fiscal Year 2018*, p. 104, http://www.osec.doc.gov/bmi/budget/FY18BIB/All508.pdf.

[13] For more information on the NMI, see CRS Report R43857, *The Network for Manufacturing Innovation*, by John F. Sargent Jr. For more information on the NNMI proposal, see CRS Report R42625, *The Obama Administration's Proposal to Establish a National Network for Manufacturing Innovation*, by John F. Sargent Jr.

[14] The act also directs NIST to merge its Advanced Manufacturing Technology Consortia (AMTech) program into the NNMI.

direction of the Revitalize American Manufacturing and Innovation Act of 2014 in requiring open competition to select the technological focus areas of industry-driven manufacturing institutes."[15]

In September 2016, Commerce Secretary Penny Pritzker announced that "Manufacturing USA" would be the new brand name for the National Network for Manufacturing Innovation. Congress continues to use the term National Network for Manufacturing Innovation in appropriations reports.

On February 19, 2016, NIST launched a competition to establish and operate one or more institutes. According to the announcement, NIST intended to provide up to a total of $70 million per institute over five to seven years, with federal funding matched by private and other nonfederal sources. On December 16, 2016, NIST awarded the National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL), led by the University of Delaware, "to advance U.S. leadership in biopharmaceutical manufacturing."[16] The Consolidated Appropriations Act, 2017 (P.L. 115-31) provided $25 million to NIST for the NNMI, to include funding for center establishment and up to $5,000,000 for coordination activities. The Consolidated Appropriations Act, 2018 (P.L. 115-141) provides $15 million to NIST for the NNMI for FY2018, to include funding for center establishment and up to $5 million for coordination activities. President Trump is requesting $15.1 million for FY2019 for Manufacturing USA, including $5.1 million for coordination activities.

Previous NIST Programs

In July 2013, NIST launched two new programs: the Advanced Manufacturing Technology Consortia (AMTech) program and the Manufacturing Technology Acceleration Centers (M-TAC) program.

Advanced Manufacturing Technology Consortia Program

Originally included in President Obama's FY2013 budget request, AMTech makes planning awards to "establish industry-led consortia to identify and prioritize research projects supporting long-term industrial research needs." AMTech seeks to incentivize manufacturers to share financial and scientific resources with universities, state and local governments, and nonprofit organizations.[17] AMTech does not have a statutory authorization; the Consolidated and Further Continuing Appropriations Act, 2013 (P.L. 113-6) provided first-year funding of $14.5 million.

In December 2015, the Consolidated Appropriations Act, 2016 (P.L. 114-113) directed NIST to merge the Advanced Manufacturing Technology (AMTech) Consortia program with the NNMI.[18]

[15] Explanatory Statement, Consolidated Appropriations Act, 2016, Division B (Commerce, Justice, Science and Related Agencies Appropriations Act), *Congressional Record*, Vol. 161, No. 184-Book II (December 17, 2015), p. H9733.

[16] Office of Advanced Manufacturing, National Institute of Standards and Technology (NIST), Department of Commerce (DOC), website, "NIST Manufacturing USA Institutes," https://www.nist.gov/amo/nist-manufacturing-usa-institutes.

[17] NIST, "President's FY 2013 Budget Request for NIST Targets Advanced Manufacturing, Critical Science and Technology Programs," press release, February 13, 2012, http://www.nist.gov/public_affairs/releases/budget_2013.cfm.

[18] Explanatory Statement, Consolidated Appropriations Act, 2016, P.L. 114-113, Division B, p. 7.

Manufacturing Technology Acceleration Centers Program

The M-TAC program was a pilot effort under MEP, seeks to address "the technical and business challenges encountered by small and mid-sized U.S. manufacturers as they attempt to adopt, integrate, and execute advanced product and process technologies into their operations."[19] The funded project work on all the MTAC projects has been completed and a final presentation was made by each awardee to MEP Center directors and staff in May 2016.

NIST Appropriations

Overview of NIST Appropriations Accounts

Discretionary funding for NIST is generally provided through three appropriations accounts:

- The Scientific and Technical Research and Services (STRS) account supports NIST in-house laboratory research. The account also provided funding for the Baldrige Performance Excellence Program through FY2011.
- The Construction of Research Facilities (CRF, also referred to in this report as construction) account supports construction, maintenance, and repair of NIST facilities at its facilities in Gaithersburg, MD, and Boulder, CO. From FY2008 to FY2010, CRF provided funding for a competitive grant program that funded the construction of research facilities at U.S. universities and research institutions.
- The Industrial Technology Services (ITS) account supports NIST's extramural programs. In FY2018, the ITS account provides funding for the MEP and NNMI programs. In earlier years, ITS provided funding for the Advanced Technology Program, the Technology Innovation Program, and the AMTech program.

NIST FY2019 Appropriations

President Trump requested a total of $629.1 million for NIST in FY2019, $569.4 million (47.5%) below the FY2018 enacted level of $1,198.5 million. The President's FY2019 request included $573.4 million for R&D, standards coordination, and related services in the STRS account, a decrease of $151.1 million (20.9%) from the FY2018 level of $724.5 million. The House Appropriations Committee-reported level for FY2019 is $985 million, $213.5 million (17.8%) below the FY2018 level and $355.9 million (56.6%) above the request. The Senate Appropriations Committee-reported level for FY2019 is $1,037.5 million, $161.0 million (13.4%) below the FY2018 level, $408.4 million (64.9%) above the request, and $52.5 million (5.3%) above the House committee-reported level.

The President requested $15.1 million for the ITS account for FY2019, down $139.9 million (90.3%) from the FY2018 enacted level. The President's FY2019 request for ITS would discontinue funding for the Manufacturing Extension Partnership (MEP) program, and provide $15.1 million for the National Network for Manufacturing Innovation (NNMI)/Manufacturing USA, essentially the same as the FY2018 enacted level.[20] The $15.1 million sought for the NNMI

[19] Advanced Manufacturing National Program Office, "Explaining AMTech, M-TAC and NNMI: New NIST Programs in Support of Advanced Manufacturing," http://www.manufacturing.gov/docs/Explaining_AMTech_M-TAC_NNMI.pdf.

[20] Ibid. For additional information on the MEP program, see CRS Report R44308, *The Manufacturing Extension Partnership Program*, by John F. Sargent Jr.

includes $10.0 million for continued support of the NIST-sponsored National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL) and $5.1 million to support NIST's role in coordination of the network. The House Appropriations Committee-reported level for the ITS account for FY2019 is $145.0 million, $10.0 million (6.5%) below the FY2018 level and $129.9 million (860.6%) above the request. The Senate Appropriations Committee-reported level for the ITS account for FY2019 is $155.0 million, equal to the FY2018 level, $139.9 million (926.9%) above the request, and $10.0 million (6.9%) above the House committee-reported level. Both the House and Senate committee reports would provide $140.0 million for the MEP program for FY2019; for the NNMI, the House would provide $5.0 million and the Senate would provide $15.0 million.

The President requested $40.5 million for FY2019 for the NIST CRF account, down $278.5 million (87.3%) from the FY2018 enacted level.[21] The House Appropriations Committee-reported level for the CRF account for FY2019 is $120.0 million, $199.0 million (62.4%) below the FY2018 level and $79.5 million (195.9%) above the request. The Senate Appropriations Committee-reported level for the CRF account for FY2019 is $158.0 million, $161.0 million (50.5%) below the FY2018 level, $117.5 million (289.7%) above the request, and $38.0 million (31.7%) above the House committee-reported level.

This section will be updated as Congress completes action on the FY2019 appropriations process.

Table 1. NIST Appropriations

(budget authority, in millions of dollars)

Budget Account	FY2018 Enacted	FY2019 Request	FY2019 House	FY2019 Senate	FY2019 Enacted
Scientific and Technical Research and Services	$724.5	$573.4	$720.0	$724.5	
Industrial Technology Services	155.0	15.1	145.0	155.0	
Manufacturing Extension Partnership	140.0	0.0	140.0	*140.0*	
Network for Manufacturing Innovation	15.0	15.1	*5.0*	*15.0*	
Construction of Research Facilities	319.0	40.5	120.0	158.0	
NIST, Total	**$1,198.5**	**$629.1**	**$985.0**	**1,037.5**	

Source: Explanatory Statement for H.R. 1625, the Consolidated Appropriations Act, 2018 (P.L. 115-141); National Institute of Standards and Technology, U.S. Department of Commerce, *National Institute of Standards and Technology, Fiscal Year 2019 Budget Submission to Congress;*H.Rept. 115-704; andS.Rept. 115-275.

Note: Columns may not add to totals due to rounding.

[21] National Institute of Standards and Technology, U.S. Department of Commerce, *National Institute of Standards and Technology, Fiscal Year 2019 Budget Submission to Congress,* pp. 3-4.

Funding Trends for NIST Accounts and Selected Programs

This section provides an overview of appropriations data for NIST in total and for each of its appropriations accounts, as well as for the Manufacturing Extension Partnership and the Advanced Technology Program (eliminated in 2007) and the Technology Innovation Program (last funded in 2011). **Appendix A** provides requested and enacted funding levels for NIST and its accounts for FY2003-FY2019. **Appendix B** provides requested and enacted funding levels for selected NIST programs.

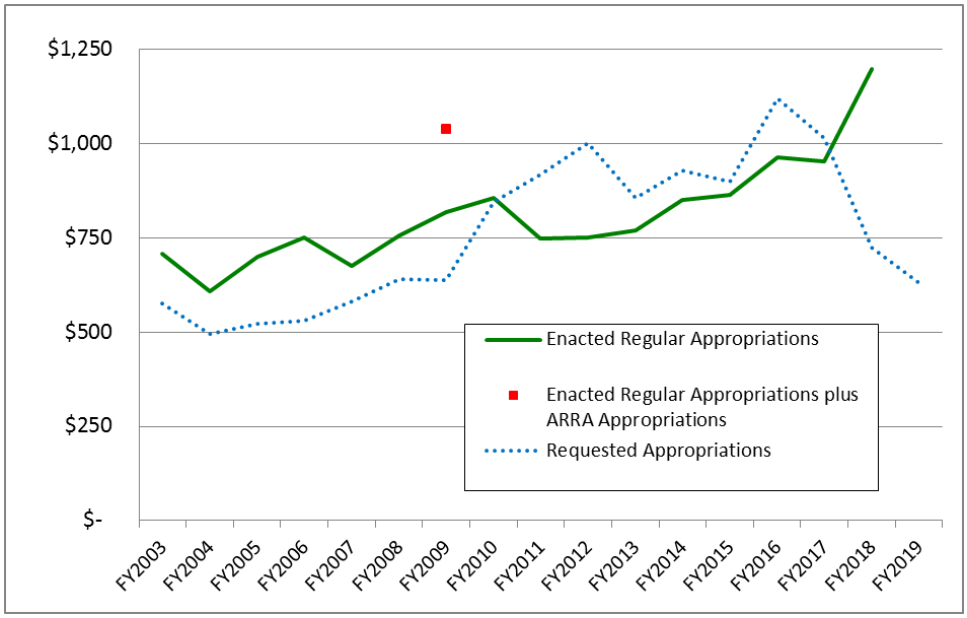
Total NIST Funding

Figure 1 illustrates total requested and enacted NIST funding levels. Total appropriations for NIST grew from $707.5 million in FY2003 to $1,198.5 million in FY2018, a compound annual growth rate (CAGR) of 3.6%. Appropriations exceeded requests through FY2010; from FY2010 to FY2017, requests exceeded appropriations. In FY2018, appropriations once again exceeded the request. President Trump is requesting $629.1 million for NIST in FY2019, a $569.4 million (47.5%) reduction from the FY2018 appropriation level.

Figure 1. Total NIST Appropriations

Enacted Appropriations, FY2003-FY2018; Requested Appropriations, FY2003-FY2019

(in millions of current dollars)



Sources: Department of Commerce and NIST budget documents, FY2003-FY2019; P.L. 115-141 and accompanying explanatory statement.

Note: ARRA = American Recovery and Reinvestment Act.

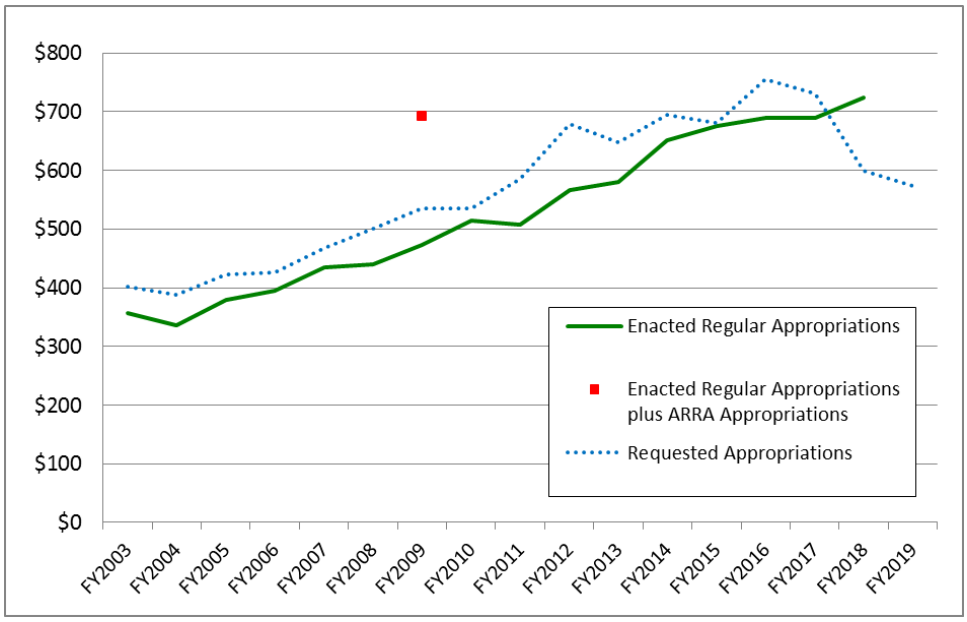
Scientific and Technical Research and Services Account

Figure 2 illustrates requested and enacted funding levels for the NIST STRS account. This account saw a steady rise in both request and appropriations levels through FY2016. STRS funding requests declined in FY2017, FY2018, and FY2019. Appropriations for FY2017 were $10.0 million below the FY2016 level. In FY2018, Congress appropriated $724.5 million, an increase of $34.5 million (5.0%) above the FY2017 level of $690.0 million. For FY2019, President Trump is requesting $573.4 million for STRS, a $151.1 million (20.9%) reduction from the FY2018 appropriation level. Total appropriations for the STRS account grew from $357.1 million in FY2003 to $724.5 million in FY2018, a compound annual growth rate of 4.8%.

Figure 2. Scientific and Technical Research and Services Account

Enacted Appropriations, FY2003-FY2018; Requested Appropriations, FY2003-FY2019

(in millions of current dollars)



Sources: Department of Commerce and NIST budget documents, FY2003-FY2019; P.L. 115-141 and accompanying explanatory statement.

Note: ARRA = American Recovery and Reinvestment Act.

Construction of Research Facilities Account

Figure 3 illustrates requested and enacted funding levels for the NIST CRF account. The construction account has seen substantial fluctuations from FY2006 through FY2018. CRF funding jumped from $72.5 million in FY2006 to $173.7 million in FY2007, fell to $58.7 million in FY2008, and then rose to $532.0 million in FY2009 (of which $172.0 million was provided for in regular appropriations and $360 million provided under ARRA).[22] In 2010, funding fell to $147.0 million, and fell again in 2011 to $69.9 million. Falling again in FY2012 to $55.4 million, appropriations remained relatively flat through FY2015, ranging from $50 million to $56 million per year. In FY2016, CRF appropriations jumped to $119.0 million; $60.0 million of the increase

[22] Of the $360 million that ARRA provided this account in FY2009, $180 million was designated for the competitive construction grant program.

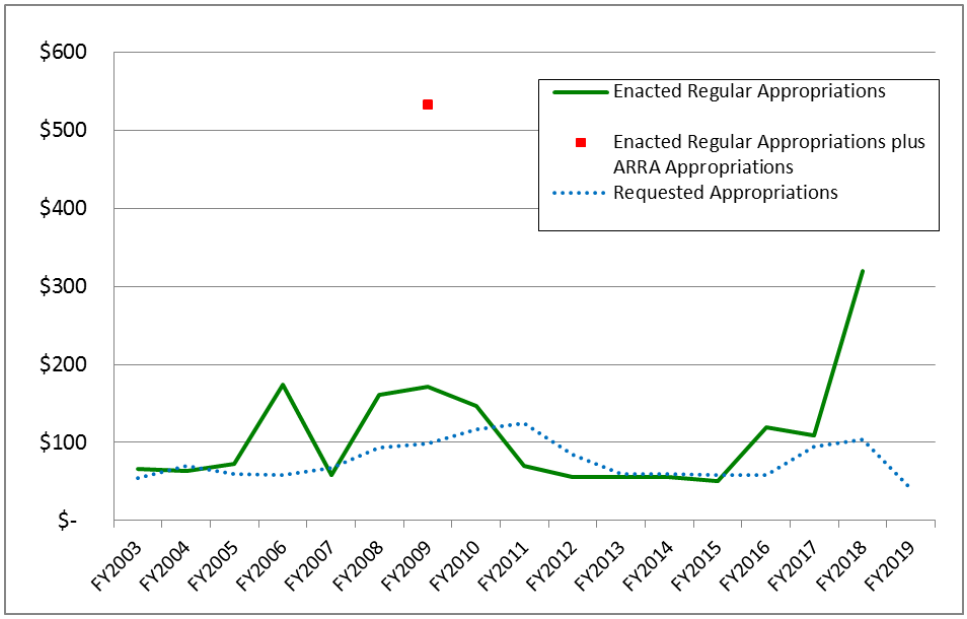
was designated for beginning "the design and renovation of [NIST's] outdated and unsafe radiation physics infrastructure." In FY2017, CRF appropriations were $109.0 million, of which $60.0 million was designated for design and renovation of NIST's radiation physics infrastructure.[23] In FY2018, CRF appropriations jumped to $319 million, an increase of $210.0 million (192.7%) from the FY2017 level. President Trump is requesting $40.5 million for CRF in FY2019, a $278.5 million (87.3%) reduction from the FY2018 appropriation level.

In FY2008, FY2009, and FY2010, the CRF account provided funding for the competitive construction grant program that funded the construction of research facilities at U.S. universities and research institutions. Appropriations for CRF also included funding for congressionally designated projects in some years. **Figure 4** illustrates the funding levels for the NIST CRF account excluding congressionally directed projects and the competitive grant program (requested appropriations for FY2003-FY2019 and enacted appropriations for FY2003-FY2018).

Figure 3. Construction of Research Facilities Account

Enacted Appropriations, FY2003-FY2018; Requested Appropriations, FY2003-FY2019

(in millions of current dollars)



Sources: Department of Commerce and NIST budget documents, FY2003-FY2019; P.L. 115-141 and accompanying explanatory statement.

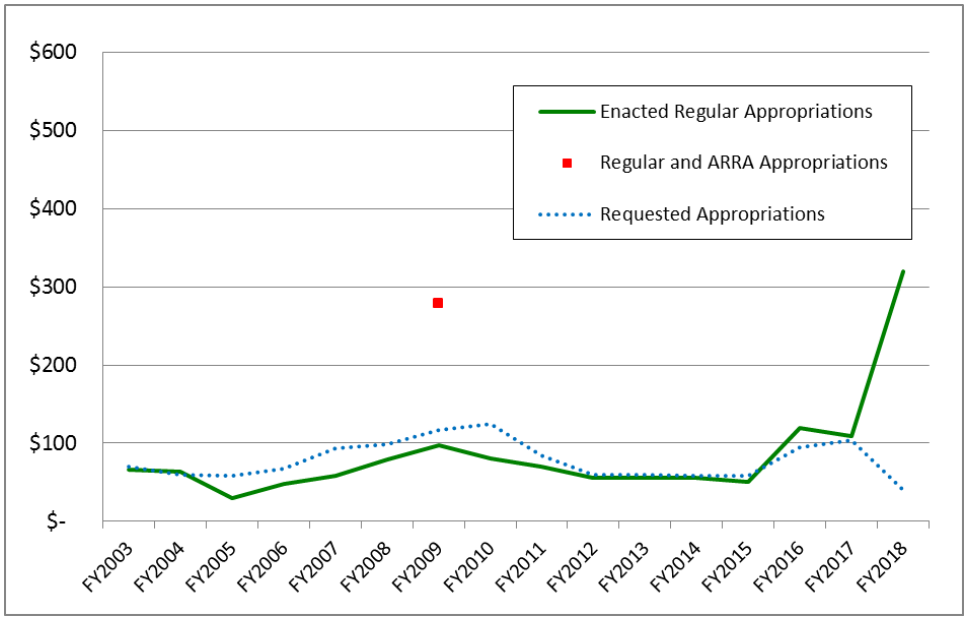
Note: ARRA = American Recovery and Reinvestment Act.

[23] P.L. 115-31.

Figure 4. Construction of Research Facilities Account, Excluding Funding for Congressionally Directed Projects and the Competitive Construction Grant Program

Enacted Appropriations, FY2003-FY2018; Requested Appropriations, FY2003-FY2019

(in millions of current dollars)



Sources: Department of Commerce and NIST budget documents, FY2003-FY2019; P.L. 115-141 and accompanying explanatory statement.

Note: ARRA = American Recovery and Reinvestment Act.

Industrial Technology Services Account

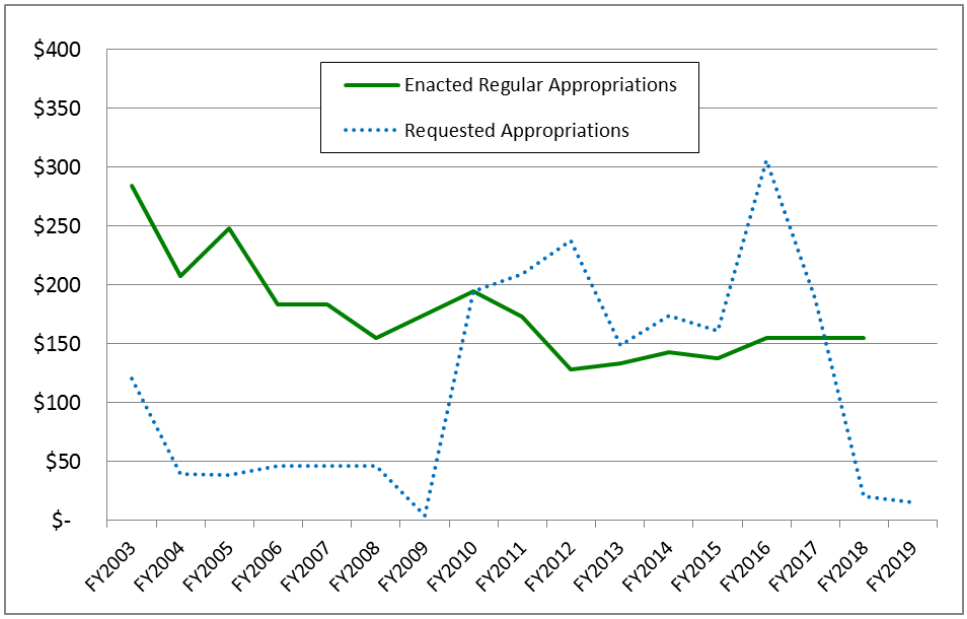
Figure 5 illustrates requested and enacted funding levels for the NIST ITS account. ITS requests and appropriations during this period have included the MEP, NNMI, AMTech, ATP, TIP, and Baldrige programs in some or all years. Total appropriations for the ITS account fell from $284.8 million in FY2003 to $128.4 million in FY2012, grew to $155.0 million in FY2016 and have since remained flat. President Trump is requesting $15.1 million for ITS in FY2018, a $139.9 million (90.3%) reduction from the FY2018 appropriation level. Substantial fluctuations in the

levels of funding requested and provided for the MEP, ATP, and TIP programs are reflected in aggregate in **Figure 5**, and illustrated and discussed in more detail on the following pages.

Figure 5. Industrial Technology Services Account

Enacted Appropriations, FY2003-FY2018; Requested Appropriations, FY2003-FY2019

(in millions of current dollars)



Sources: Department of Commerce and NIST budget documents, FY2003-FY2019; P.L. 115-141 and accompanying explanatory statement.

Manufacturing Extension Partnership Program

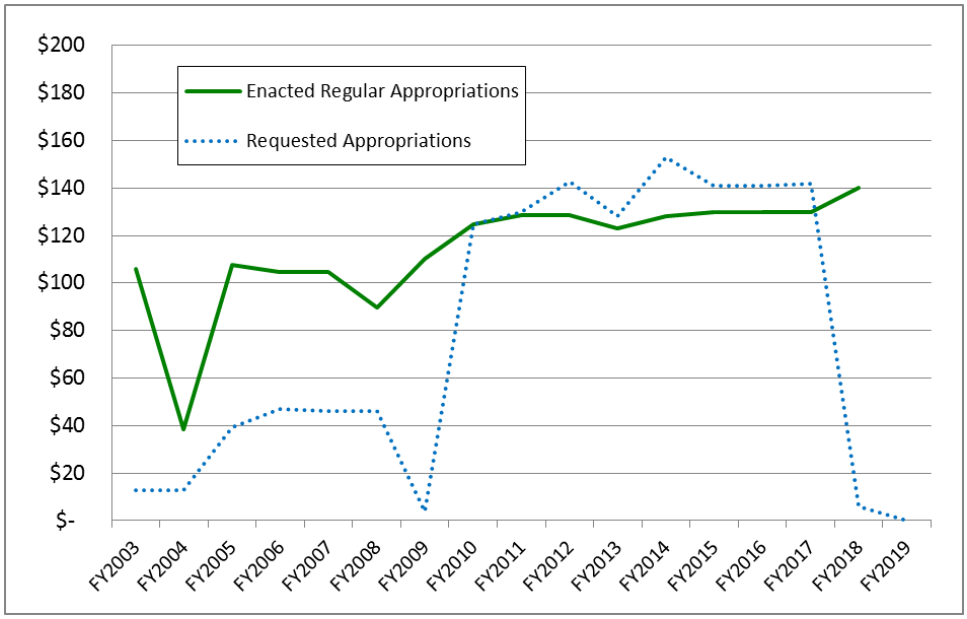
Figure 6 illustrates requested and enacted funding levels for the NIST MEP program. FY2003 enacted appropriations of $105.9 million were cut to $38.6 million in FY2004, but returned to near the FY2003 level in FY2005 ($107.5 million) and stayed near that level through FY2007. The MEP funding dipped again in FY2008, to $89.6 million, then rose over the next several years to $140.0 million in FY2018. Requests from FY2003 to FY2009 were substantially lower than appropriations, falling to $2.0 million in FY2009. In FY2010, the Obama Administration requested $124.7 million for MEP. From FY2012 to FY2017, requests were somewhat higher than enacted appropriations. For FY2018, President Trump requested $6.0 million for the MEP program to provide "for the orderly wind down of federal funding for the program"; however,

Congress appropriated $140.0 million.[24] In FY2019, President Trump is requesting no funding for MEP, $140.0 million (100.0%) below the FY2018 appropriation level.

Figure 6. Manufacturing Extension Partnership Program

Enacted Appropriations, FY2003-FY2018; Requested Appropriations, FY2003-FY2019

(in millions of current dollars)



Sources: Department of Commerce and NIST budget documents, FY2003-FY2019; P.L. 115-141 and accompanying explanatory statement.

[24] U.S. Department of Commerce, NIST, *National Institute of Standards and Technology/National Technical Information Service Fiscal Year 2018 Budget Submission to Congress*, May 2017, p. NIST-4.

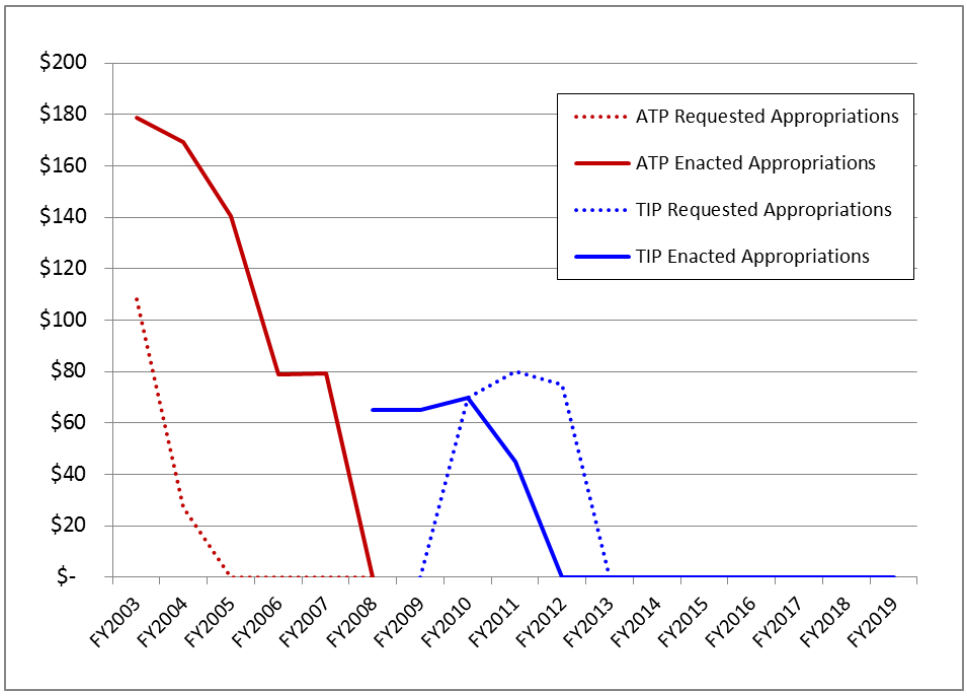
Advanced Technology Program/Technology Innovation Program

The Advanced Technology Program saw its requests fall from $107.9 million in FY2003 to zero in FY2005, and its appropriations fall from $178.9 million in FY2003 to zero in FY2008; no funding was requested in FY2005 and subsequent years. The Technology Innovation Program, which succeeded ATP, was first funded at $65.2 million in FY2008 and rose to $69.9 million in FY2010 before falling to $45.0 million in FY2011. The TIP program received no funding in FY2012 or in subsequent years. The $69.9 million requested for TIP in FY2010 was fully funded; in FY2011 the TIP request was $79.9 million, and in FY2012 was $75.0 million. No funding has been requested for TIP since FY2012.

Figure 7. Advanced Technology Program and Technology Innovation Program

Enacted Appropriations, FY2003-FY2018; Requested Appropriations, FY2003-FY2019

(in millions of current dollars)



Sources: Department of Commerce and NIST budget documents, FY2003-FY2019.

Concluding Observations

When NBS was renamed NIST under the provisions of the Omnibus Trade and Competitiveness Act of 1988, the laboratory was given additional missions and supporting programs. Two of the new programs—the Advanced Technology Program and the Manufacturing Extension Partnership program—were intended to improve U.S. innovation and industrial competitiveness. These programs generated criticism from some policymakers and analysts who objected to them on a variety of grounds, including whether such activities are appropriate for the federal government to undertake; whether they might result in suboptimal choices of technologies, choices better left to market forces; whether certain technologies, companies, or industries might be chosen for support based on criteria other than technical or business merit; and whether tax dollars should be awarded to already-profitable firms.

In contrast, NIST's historical mission of conducting laboratory research in support of standards and metrics continued to enjoy broad support and faced little controversy. Evidence of this support can be seen in the selection of the STRS account—through which NIST laboratory work is funded—as one of the targeted accounts in the doubling efforts of former presidents George W. Bush and Barack Obama and successive Congresses. However, even with broad support and the absence of controversy, funding for the NIST STRS account did not grow at the pace its advocates supported in presidential budget requests and successive authorizations of appropriations due to tight overall fiscal constraints on the federal budget.

These issues are discussed in more detail below.

NIST Doubling Effort

In the early 2000s, many industry, academia, and policy leaders expressed growing concern that federal investments in physical sciences and engineering research were not growing fast enough to keep America on the leading edge of technological innovation and commercial competitiveness. In his 2006 State of the Union remarks, President Bush announced the American Competitiveness Initiative (ACI) which, among other things, sought to double funding for targeted appropriations accounts that fund physical sciences and engineering research over a 10-year period. Among the targeted accounts were the NIST STRS and construction accounts. Subsequently, Congress passed the America COMPETES Act (P.L. 110-69), which set appropriations authorizations for the targeted accounts for FY2008-FY2010 that represented a compound annual growth rate (CAGR) of 10.1% that would have, if continued, resulted in a doubling over approximately seven years.

In his FY2010 *Plan for Science and Innovation*, President Obama stated that he (like President Bush) would seek to double funding for basic research over 10 years (FY2006 to FY2016) at the ACI agencies. Actual appropriations, however, did not keep pace with the America COMPETES Act authorization levels. In his FY2011 budget request, President Obama extended the period over which he intended to double these agencies' budgets to 11 years. In 2010, Congress enacted the America COMPETES Reauthorization Act of 2010 (P.L. 111-358), setting appropriations authorizations for the targeted accounts for FY2011-FY2013 at a level that effectively set an 11-year doubling pace (a 6.3% CAGR). However, as with the original act, appropriations did not keep pace with the authorization act levels. While reiterating President Obama's intention to double funding for the targeted accounts from their FY2006 levels, President Obama's FY2013 budget request did not specify the length of time over which the doubling was to take place. President Obama's FY2014 budget expressed a commitment to increasing funding for the targeted accounts, but did not commit to doubling. President Obama's FY2017 budget did not

address the doubling effort. From FY2006, the base year for the doubling effort, through FY2016, funding for the NIST STRS and construction accounts grew by 42.3% in nominal terms, a compound annual growth rate of 3.6%, a rate that would result in doubling in about 20 years. President Obama's FY2017 request sought an increase in aggregate funding for these accounts of 2.0%. President Trump's FY2018 and FY2019 budget requests did/do not mention doubling. The doubling effort appears to no longer be a priority for Congress or the President. It remains to be seen how support for internal R&D at NIST will evolve.

NIST Technology Policy

Some of NIST's external programs have faced substantial opposition over time. Beginning with the 104th Congress, many Members expressed skepticism over a "technology policy" based on providing federal funds to industry for development of precompetitive generic technologies. This philosophical shift from previous Congresses, coupled with pressures to balance the federal budget, led to significant reductions in funding for NIST's external programs. The Advanced Technology Program and the Manufacturing Extension Partnership, which accounted for over 50% of the FY1995 NIST budget, were proposed for elimination. Although in the past strong support by the Senate led to their continued financing, funding for ATP remained controversial. Beginning in FY2000, the House-passed appropriations bills did not contain funding for ATP, and many of the budget proposals submitted by former President George W. Bush called for abolishing the program. In the 110th Congress, the America COMPETES Act eliminated ATP and replaced it with the TIP initiative. While TIP received appropriations from FY2008 to FY2011, it has received no appropriations since. In his FY2003 budget proposal, President Bush also recommended suspension of federal support for those MEP centers in operation for more than six years; the following year funding for the MEP program was significantly reduced. However, the FY2005 Omnibus Appropriations Act brought support for MEP back up to the level necessary to fully fund the existing centers. Since then, funding has grown from $107.5 million in FY2005 to $130.0 million in FY2016. President Obama requested $142.0 million for MEP for FY2017, an increase of $12.0 million (9.2%); Congress provided $130 million, an amount equal to its FY2016 level. For FY2017, Congress provided $140.0 million for MEP. President Trump's FY2018 budget request sought to end the MEP program, providing $6.0 million in FY2018 to provide "for the orderly wind down of federal funding for the program."[25] President Trump's FY2019 request would provide no funding for MEP. For more information on the MEP program, see CRS Report R44308, *The Manufacturing Extension Partnership Program*, by John F. Sargent Jr.

National Network for Manufacturing Innovation

In his FY2013 budget, President Obama requested $1 billion in mandatory funding for the creation of a National Network for Manufacturing Innovation[26] to help accelerate innovation by investing in industrially relevant manufacturing technologies with broad applications, and to support manufacturing technology commercialization by bridging the gap between the laboratory and the market. Congress did not act on this request or on President Obama's FY2014 request for the same amount. In FY2015, President Obama requested $2.4 billion for the NNMI as part of his Opportunity, Growth, and Security Initiative. President Obama also requested $5.0 million for

[25] U.S. Department of Commerce, NIST, *National Institute of Standards and Technology/National Technical Information Service Fiscal Year 2018 Budget Submission to Congress*, May 2017, p. NIST-4.

[26] For more information on President Obama's proposed National Network for Manufacturing Innovation, see CRS Report R42625, *The Obama Administration's Proposal to Establish a National Network for Manufacturing Innovation*, by John F. Sargent Jr.

coordination of manufacturing innovation institutes as part of NIST's budget request. In December 2014, Congress enacted the Revitalize American Manufacturing and Innovation (RAMI) Act of 2014 as Title VII of Division B of the Consolidated and Further Continuing Appropriations Act, 2015 (P.L. 113-235), establishing a Network for Manufacturing Innovation (NMI). The act does not appropriate funds specifically for the NMI program but instead authorizes NIST to spend up to $5.0 million of funds appropriated to NIST's ITS account each year from FY2015 to FY2024 to carry out the program. In addition, the act authorizes the Department of Energy (DOE) to transfer up to $250.0 million to NIST for the 10-year period FY2015 to FY2024 to carry out the program.[27] As of the date of this report, DOE has not transferred any funding to NIST for this purpose.

Through the end of calendar year 2015, seven NNMI institutes sponsored by the Department of Defense (DOD) and Department of Energy had been awarded, and two additional institutes were being competed. In December 2015, Congress appropriated specific funding, for the first time, for the establishment and coordination of institutes under the provisions of the RAMI Act. The Consolidated Appropriations Act, 2016 (P.L. 114-113) provided NIST with $25.0 million for FY2016 for the NNMI, to include funding for establishment of institutes and up to $5.0 million for coordination activities. The explanatory statement accompanying the act directed NIST to "follow the direction of the Revitalize American Manufacturing and Innovation Act of 2014 in requiring open competition to select the technological focus areas of industry-driven manufacturing institutes."[28]

NIST subsequently announced its intention to establish two institutes.[29] On December 16, 2016, NIST awarded the National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL), led by the University of Delaware, "to advance U.S. leadership in biopharmaceutical manufacturing."[30] NIST did not award a second institute due to a lack of funds.

P.L. 115-141 provides $15.0 million for NIST NNMI efforts in FY2018, to include funding for its center and $5.0 million for coordination activities. President Obama had requested $25.0 million in discretionary funding and $1.9 billion in mandatory funding for NIST to establish institutes and coordinate the activities of the network.

As of the date of this report, 14 NNMI institutes have been established—8 by DOD, 5 by DOE, and 1 by the Department of Commerce.

President Trump is requesting $15.1 million for NIST NNMI activities in FY2019, including $10.0 million for continued support of the NIST-sponsored National Institute for Innovation in Manufacturing Biopharmaceuticals and $5.1 million for coordination of the network.[31] The Trump Administration's FY2019 budget request includes no funding for the NNMI at the DOE Office of Advanced Manufacturing, which has been the source of funding for DOE-sponsored NNMI institutes.

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[27] The act authorizes the Department of Energy to provide the funds only from amounts appropriated for advanced manufacturing research and development within its Energy Efficiency and Renewable Energy account.

[28] Explanatory Statement, P.L. 114-113.

[29] National Institute of Standards and Technology, Department of Commerce, *Notice of Intent: National Network for Manufacturing Innovation (NNMI) Institute Awards*, December 21, 2015, http://www.nist.gov/amo/nnmi/upload/NIST-NNMI-NOI-2015-12-21.pdf.

[30] Office of Advanced Manufacturing, National Institute of Standards and Technology (NIST), Department of Commerce (DOC), website, "NIST Manufacturing USA Institutes," https://www.nist.gov/amo/nist-manufacturing-usa-institutes.

[31] National Institute of Standards and Technology, U.S. Department of Commerce, *National Institute of Standards and Technology, Fiscal Year 2019 Budget Submission to Congress.*

As Congress completes the FY2019 appropriations process, an overarching issue will be how to respond to the Trump Administration's FY2019 NIST budget request and its policy implications, how much funding to provide to NIST in aggregate, and how to allocate NIST appropriations among the core standards and measurement functions performed by its laboratories and NIST external programs, such as MEP, AMTech, and the NMI.

For a broader discussion about the Network for Manufacturing Innovation and associated policy issues, see CRS Report R44371, *The National Network for Manufacturing Innovation*, by John F. Sargent Jr.

Appendix A. Requested and Enacted Discretionary Appropriations for NIST Accounts

Table A-1. Requested and Enacted Appropriations for NIST Accounts

Enacted Appropriations, FY2003-FY2018; Requested Appropriations, FY2003-FY2019

(in millions of current dollars)

Fiscal Year	NIST, Total		Scientific and Technical Research and Services (STRS)[a]		Industrial Technology Services (ITS)[a]		Construction of Research Facilities (CRF)	
	Request	Enacted	Request	Enacted	Request	Enacted	Request	Enacted
2019	$629.1		$573.4		$15.1		$40.5	
2018	725.0	$1,198.5	600.0	$724.5	21.0	$155.0	104.0	$319.0
2017	1,014.5	954.0	730.5	690.0	189.0	155.0	95.0	109.0
2016	1,119.7	964.0	754.7	690.0	306.0	155.0	59.0	119.0
2015	900.0	863.9	680.0	675.5	161.0	138.1	59.0	50.3
2014	928.3	850.0	693.7	651.0	174.5	143.0	60.0	56.0
2013[b]	857.0	769.4	648.0	579.8	149.0	133.6	60.0	56.0
2012	1,001.1	750.8	678.9	567.0	237.6	128.4	84.6	55.4
2011[c]	918.9	750.1	584.5	507.0	209.6	173.2	124.8	69.9
2010	846.1	856.6	534.6	515.0	194.6	194.6	116.9	147.0
2009[d]	636.0	819.0	535.0	472.0	4.0	175.0	99.0	172.0
2009 ARRA[e]	—	580.0	—	220.0	—	—	—	360.0
2008[f]	640.7	755.8	500.5	440.5	46.3	154.8	93.9	160.5
2007	581.3	676.9	467.0	434.4	46.3	183.8	68.0	58.7
2006[g]	532.0	752.0	426.3	394.8	46.8	183.6	58.9	173.7
2005[h]	521.5	699.2	422.9	378.8	39.2	247.9	59.4	72.5
2004[i]	496.8	608.5	387.6	336.5	39.6	207.8	69.6	64.3
2003[j]	577.5	707.5	402.2	357.1	120.8	284.8	54.5	65.7

Sources: Department of Commerce and NIST budget documents, FY2003-FY2018; P.L. 115-141 and accompanying explanatory statement.

Notes: Dashes in cells in this table indicate no request or appropriation was made for that year. Accounts may not add to totals due to rounding.

a. Funding for the Baldrige Performance Excellence Program was provided in the STRS account appropriation through FY2011; in FY2012, funding was requested in the ITS account appropriation.

b. Enacted levels reflect the 1.877% rescission, 0.2% rescission, and the 5% sequester applied to 2013 annualized CR level.

c. Enacted levels include 0.2% across-the-board rescission.

d. Enacted levels for STRS appropriation include $3.475 million in congressionally directed projects. The FY2009 amount for CRF appropriation includes $44 million in congressionally directed projects and $30 million for a competitive construction grant program.

e. The American Recovery and Reinvestment Act of 2009 (ARRA) amount for CRF includes $180 million for a competitive construction grant program for research science buildings. Not reflected above, ARRA also included a $20 million transfer from the Department of Health and Human Services for standards-related research on electronic medical records and an expected $10 million from a Department of Energy interagency agreement to help develop a comprehensive framework for a nationwide smart electrical grid.

f. The enacted FY2008 level for STRS appropriations includes $893,000 in congressionally directed projects. The enacted FY2008 level for CRF appropriations includes $51.3 million in congressionally directed projects and $30 million for a new competitive construction grant program that was not requested by President Bush.

g. Enacted levels reflect across-the-board rescissions enacted in P.L. 109-108, FY2006 Science, State, Justice, and Commerce Appropriations Act and in P.L. 109-148, FY2006 Defense Appropriations Act ($9.7 million). Does not reflect MEP unobligated balances rescission of $7 million. The amounts for STRS and for the Construction of Research Facilities appropriation include $11.9 million and $125.4 million for congressionally directed projects, respectively.

h. Enacted levels reflect across-the-board rescissions enacted in P.L. 108-447, FY2005 Consolidated Appropriations Act ($9.5 million). Does not reflect ATP unobligated balances rescission of $3.9 million. The amounts for STRS and for the Construction of Research Facilities appropriation include $8.8 million and $42.9 million for congressionally directed projects, respectively.

i. Enacted levels reflect across-the-board rescissions enacted in the FY2004 Consolidated Appropriations Act, P.L. 108-199 ($6.6 million) and NIST's share of the Department of Commerce's unobligated balances rescission ($13.0 million).

j. Enacted levels reflect an across-the-board rescission enacted in P.L. 108-7 ($4.6 million).

Appendix B. Requested and Enacted Appropriations for Selected NIST Programs

Table B-1. Requested and Enacted Appropriations for Selected NIST Programs

Enacted Appropriations, FY2003-FY2018; Requested Appropriations, FY2003-FY2019

(in millions of current dollars)

Fiscal Year	Hollings Manufacturing Extension Partnership		Advanced Manufacturing Technology Consortia		Manufacturing Innovation Institutes Coordination		National Network for Manufacturing Innovation		Advanced Technology Program		Technology Innovation Program	
	Request	Enacted	Request	Enacted	Request	Enacted	Request	Enacted	Request	Enacted	Request	Enacted
2019	$0.0		—		—		$15.1		—		—	
2018	6.0	$140.0	—	—	—	[a]	15.0	$15.0	—	—	—	—
2017	142.0	130.0	—	—	—	[b]	47.0	25.0	—	—	—	—
2016	141.0	130.0	$15.0	—	—		150.0	25.0	—	—	—	—
2015	141.0	130.0	15.0	$8.1	$5.0	[c]	[d]	—	—	—	—	—
2014	153.1	128.0	21.4	15.0	—	—	[d]	—	—	—	—	—
2013[e]	128.0	123.0	21.0	10.6	—	—	[d]	—	—	—	—	—
2012	142.6	128.4	12.3	—	—	—	—	—	—	—	$75.0	—
2011[f]	129.7	128.4	—	—	—	—	—	—	—	—	79.9	$44.8
2010	124.7	124.7	—	—	—	—	—	—	—	—	69.9	69.9
2009	2.0	110.0	—	—	—	—	—	—	—	—	—	65.0
2008	46.3	89.6	—	—	—	—	—	—	—	—	—	65.2
2007	46.3	104.7	—	—	—	—	—	—	—	$79.1	—	—
2006[g]	46.8	104.6	—	—	—	—	—	—	—	79.0	—	—
2005[h]	39.2	107.5	—	—	—	—	—	—	—	140.4	—	—
2004[i]	12.6	38.6	—	—	—	—	—	—	$27.0	169.1	—	—
2003[j]	12.9	105.9	—	—	—	—	—	—	107.9	178.8	—	—

Sources: Department of Commerce and NIST budget documents, FY2003-FY2018; P.L. 115-141 and accompanying explanatory statement.

Notes: Empty cells in this table indicate no request or appropriation was made for that year.

a. P.L. 115-141 authorizes NIST to use up to $5.0 million of the $15.0 provided for the National Network for Manufacturing Innovation for coordination activities of the network.

b. P.L. 115-31 authorizes NIST to use up to $5.0 million of the $25.0 provided for the National Network for Manufacturing Innovation for coordination activities of the network.

c. P.L. 113-235 states, "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."

d. President Obama requested $1 billion in mandatory funding for the NNMI for FY2013; $1 billion in mandatory funding for FY2014; and $2.4 billion in mandatory funding for FY2015.

e. Enacted levels reflect the 1.877% rescission, 0.2% rescission, and the 5% sequester applied to 2013 annualized CR level.

f. Enacted levels include 0.2% across-the-board rescission.

g. Enacted levels reflect across-the-board rescissions enacted in P.L. 109-108, FY2006 Science, State, Justice, and Commerce Appropriations Act and in P.L. 109-148, FY2006 Defense Appropriations Act.

h. Enacted levels reflect across-the-board rescissions enacted in P.L. 108-447, FY2005 Consolidated Appropriations Act ($9.5 million). Does not reflect ATP unobligated balances rescission of $3.9 million.

i. Enacted levels reflect across-the-board rescissions enacted in the FY2004 Consolidated Appropriations Act, P.L. 108-199, and NIST's share of the Department of Commerce's unobligated balances rescission.

j. Enacted levels reflect an across-the-board rescission enacted in P.L. 108-7.

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