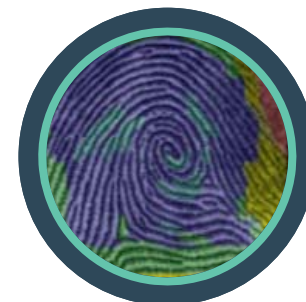

National Institute of Standards and Technology
-- FY 2017 President's Budget Request --
Working with Industry to Accelerate Innovation



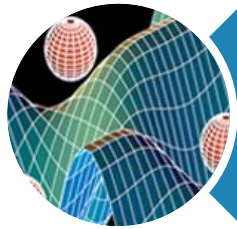
Advancing U.S. Innovation and Competitiveness

- Continue needed facility renovations
- Prioritizes resources towards core NIST mission
 - Precision measurement
 - Data and information
 - Innovation ecosystems
- Maintain support for top NIST and National priorities
 - Accelerate development of advanced manufacturing infrastructure
 - Prepare industry to advance future computing technologies
 - Support the digital economy through next-generation communications



Priorities in NIST Guidance Level FY 2017

Total Budget Request (\$1.01 B)



Scientific and Technical Research and Services \$730.5 M (+40.5 M)

Continues efforts in many areas of national importance, including future computing technologies and biomanufacturing



Industrial Technology Services \$189.0 M (+\$34.0 M)

Supports Hollings Manufacturing Extension Partnership and the National Network for Manufacturing Innovation



Construction of Research Facilities \$95.0 M (-\$24.0 M)

Provides funds for safety, capacity, maintenance, and major repair of critical NIST research facilities such as Building 245 and Boulder 1

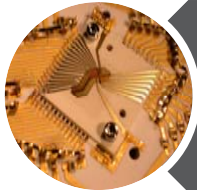
¹Mandatory Funds from FY 2017- FY 2024

NIST FY 2017 Budget Request (Dollars in millions)

	FY 2015 Enacted	FY 2016 Enacted	FY 2017 Request	+ / (-) Over FY 2016 Enacted
STRS	\$675.5	\$690.0	\$730.5	\$40.5
Laboratory Programs	591.3	605.2	638.7	33.5
Corporate Services	17.3	17.3	21.3	4.0
Stds Coord & Special Pgms	66.9	67.5	70.5	3.0
ITS	\$138.1	\$155.0	\$189.0	\$34.0
Advanced Mfg Tech Consortia	8.1	0.0	0.0	0.0
Hollings Mfg Ext Partnership	130.0	130.0	142.0	12.0
Nat'l Network for Mfg Innovation ^{1/}	0.0	25.0	47.0	22.0
CRF	\$50.3	\$119.0	\$95.0	(\$24.0)
Construc & Major Renovations	0.0	60.0	40.0	(20.0)
Saf, Cap, Maint & Maj Repairs	50.3	59.0	55.0	(4.0)
Total, NIST Discretionary	863.9	964.0	1,014.5	50.5

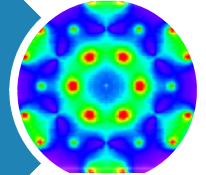
^{1/} National Network for Manufacturing Innovation is a newly proposed program in FY 2016.

STRS Summary (\$730.5 M)



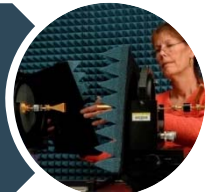
Future Computing Technologies (+\$13.6 M)
- Enable the next generation of computing technologies

Ensuring a World-Class Neutron Facility (+\$4.8 M)
- Procure reactor fuel needed to sustain continued operation of the NCNR



Advanced Sensing for Manufacturing (+\$2.0 M)
- Provide advances in sensing and measurement needed for advanced manufacturing

Advanced Communications (+\$2.0 M)
- Provide measurements that increase spectrum sharing and efficiency



Lab to Market (+\$2.0 M)
- Improve coordination of Federal Technology Transfer efforts

Engineering Principles for Efficient Biomanufacturing (+\$2.0 M)
- Develop tools to explore, manipulate and explain the complexities of biological cells

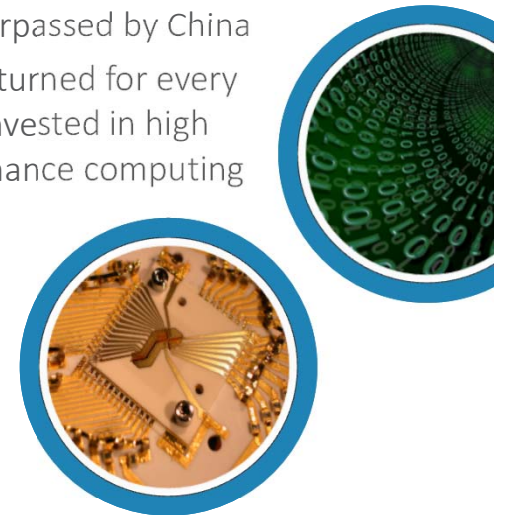


Measurement Science for Future Computing Technologies and Applications (+\$13.6 M)

- High performance computing hardware
 - Develop measurements for atomic-scale computer chip features
 - Benchmark and test new logic and memory devices
 - Enable new paradigms such as brain-like or quantum computers
- Software modeling and simulation
 - Determine how much we can trust “virtual prototyping” for complex designs
 - Better connect simulation to real-world measurements to improve product design tools

Lead in High Performance Computing

2010 - the year U.S. supercomputers were surpassed by China
\$514 returned for every dollar invested in high performance computing

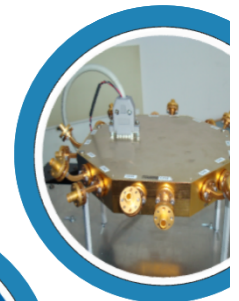


Advanced Communications – Addressing the Spectrum Crunch (+\$2.0 M)

- Increase spectrum efficiency
 - Develop metrology to support adaptive antenna systems
 - Develop accurate, traceable measurement techniques to quantify key performance metrics of digital transmitters and receivers
- Improved spectrum sharing
 - Improve performance metrics and test methods to characterize overall spectrum efficiency
 - Develop and disseminate simulation models of key components

Support advanced communication technologies to mitigate the spectrum crunch

7% - rate of new wireless connections added to the already congested frequency spectrum



Lab to Market/Technology Transfer (+\$2.0 M)

- Interagency Platform for Complementary Technology
 - Lead the development of digital platforms to enhance cross-agency collaborations on tech transfer
 - Accelerate development of new systems by enabling stakeholders to identify complementary technologies

Increase public's return through better coordination among federal laboratories

\$135B – annual level of R&D funding across federal laboratories



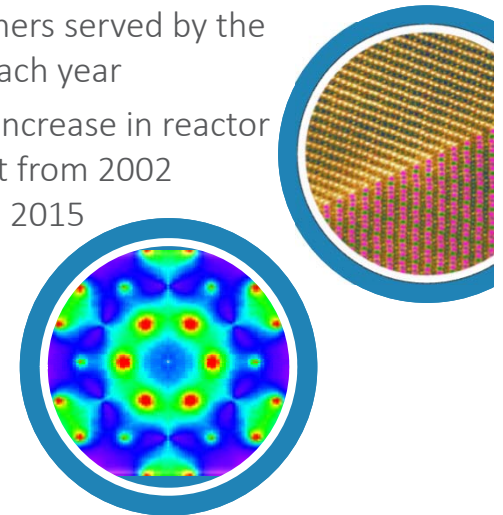
Ensuring a World Class Neutron Research Facility (+\$4.8 M)

- The NIST Center for Neutron Research (NCNR) is the only U.S. facility with a focus on enhancing industrial competitiveness
 - The NCNR uses a 20MW reactor as a neutron source
 - Procure reactor fuel to maintain current level of operation

Provide access to neutron measurement capabilities

2000 - Number of researchers served by the NCNR each year

400% - Increase in reactor fuel cost from 2002 through 2015

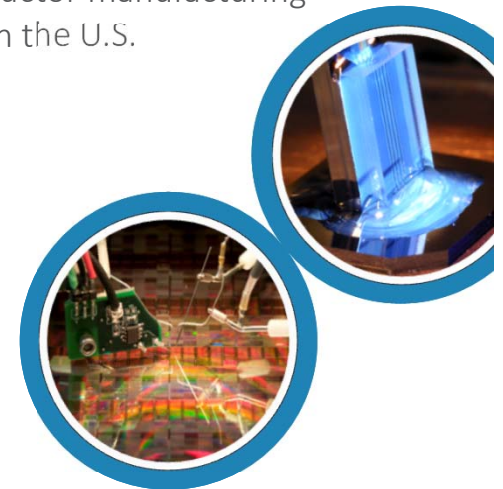


Advanced Sensing for Manufacturing (+\$2.0 M)

- Non-invasive sensing and real-time processing for high value products
 - Imaging and scattering measurements to improve process performance
 - In-process and post-process sensing for micro- and nanoscale structures
- New standards and measurements to enable new device concepts, logic, and materials
 - Sensing platforms for laser processing of semiconductors, metals, and ceramics

Enable non-invasive sensing and real-time process analysis

\$300B and growing – size of semiconductor manufacturing industry in the U.S.

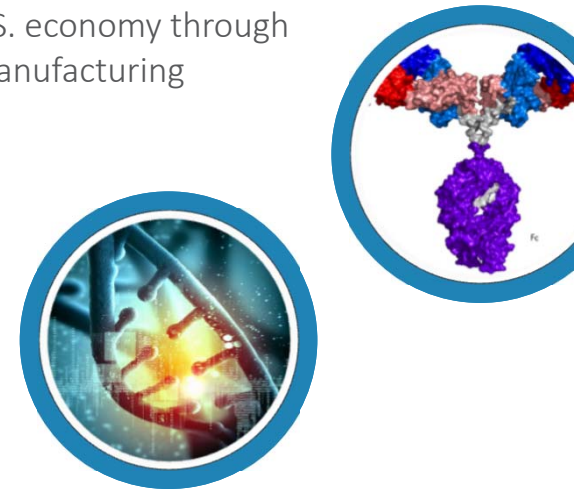


Biomanufacturing/Engineered Biology (+\$2.0 M)

- Coordinate a measurement infrastructure to support biomanufacturing
 - Convene stakeholders to identify measurement and standards needs
 - Develop methods to assure high quality measurements of biological products
- Develop robust design and testing tools for biological systems
 - Design new components for testing the function of engineered cells as “factories” to manufacture small molecule drugs and other products
 - Create a community-driven pipeline of high quality data

Improve predictability of biomanufacturing processes

\$369B – Annual revenue added to U.S. economy through biomanufacturing



ITS Summary (\$189.0 M)



- National Network for Manufacturing Innovation (\$47 M)
- An increase of \$22.0 M

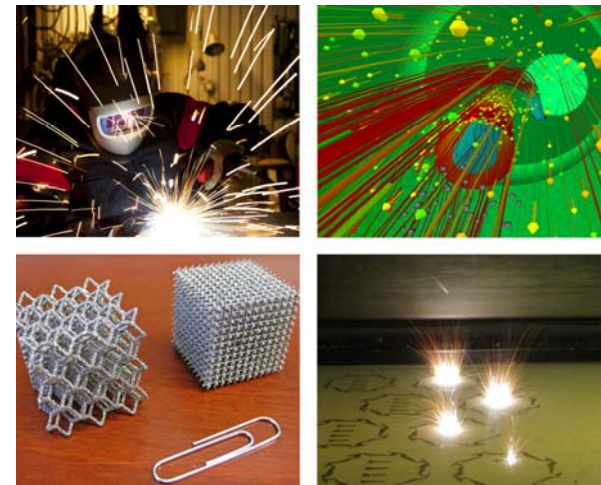


- Hollings Manufacturing Extension Partnership (\$142 M)
- An increase of \$12.0 M

National Network for Manufacturing Innovation (+\$22.0 M)

- Establish an additional institute for manufacturing innovation through open-topic competition
 - Industry proposes topics for new joint public-private funded institutes
 - Open-topic format ensures institute focus areas are important, relevant, and ready for private sector investment
 - First DOC Institutes to join the NNMI

Address industry's advanced manufacturing challenges



Hollings Manufacturing Extension Partnership (+\$12.0 M)

- Complete the competition of national MEP centers
 - Enhance local flexibility and increase accountability
- Provide MEP centers with greater capability
 - Better serve very small, rural, and start-up companies
- Expand efforts to transfer federally funded technologies
 - Better reach smaller manufacturers
 - Connect manufacturers with business opportunities

Provide more manufacturers with tools needed to respond to rapidly changing technology

12 M Americans employed in manufacturing jobs

12.5% manufacturing's contribution to the GDP

58 MEP centers nationwide

1,250 MEP technical experts solving manufacturers' challenges

29,101 clients served by MEP centers in FY 2015

Construction of Research Facilities (\$95.0 M)

- Gaithersburg - Building 245 (\$40.0 M)
 - Currently estimated to cost \$322M over FY2016-FY2024
 - FY2017 portion will fund excavation and waterproofing of existing spaces and the construction of D wing addition
 - Impact:
 - Eliminate delays in FDA-required mammography calibrations due to uncontrolled humidity levels
 - Enable installation of modern instrumentation needed for nuclear forensics standards
- Safety, Capacity, Maintenance, and Major Repairs (\$55.0M)

Facilities are essential to the NIST Mission

39 million – number of mammograms each year traceable to activities in building 245

\$347M – backlog of basic repairs across NIST



FY17 Mandatory Spending

- National Network for Manufacturing Innovation (\$1.890 B)
 - The Revitalize American Manufacturing and Innovation Act (RAMI) authorizes NIST to establish and manage the NNMI
 - Hold competitions for additional institutes
- Construction of Research Facilities (\$100.0 M)
 - In addition to discretionary CRF request
 - Provides funds for NIST to renovate and modernize NIST facilities

Mandatory funding reflects high priority in a time of limited discretionary funding

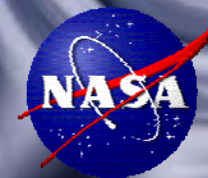


ADVANCED MANUFACTURING NATIONAL PROGRAM OFFICE
NATIONAL NETWORK FOR MANUFACTURING INNOVATION

Building a new partnership
Progress and Opportunities with the National
Network for Manufacturing Innovation

NIST Webinar
February 26, 2016

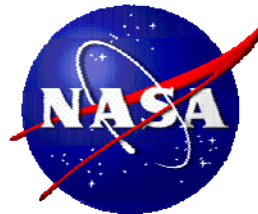
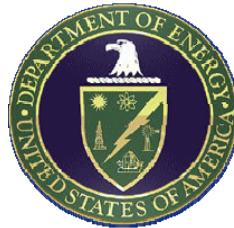
Mike Molnar
Advanced Manufacturing
National Program Office



Interagency Advanced Manufacturing National Program Office (AMNPO)



Executive Office of the President



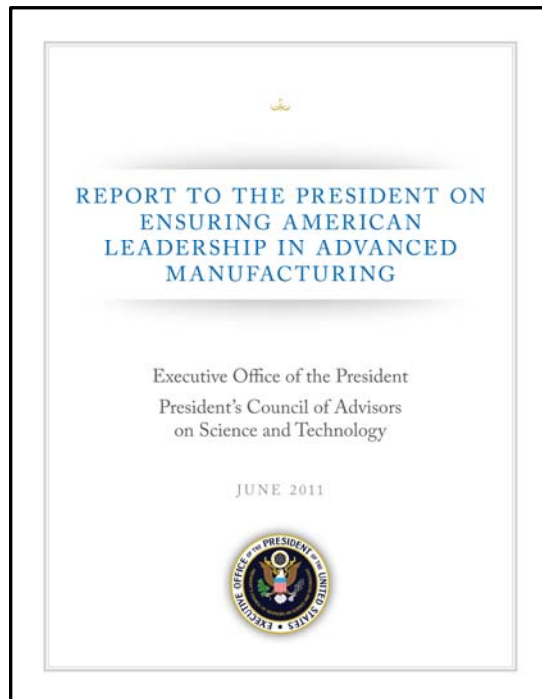
Advanced Manufacturing Partnership (AMP/PCAST)

Advanced Manufacturing National Program Office
(hosted by DOC - NIST)

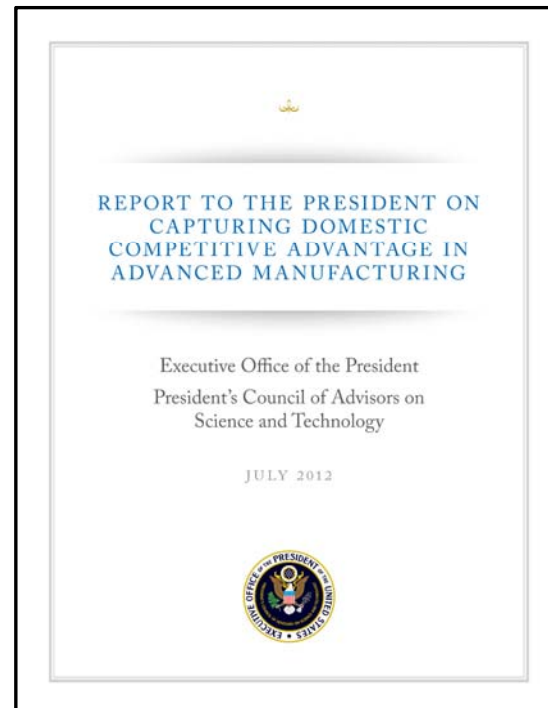
NSTC - Advanced Manufacturing Subcommittee

PCAST: The Independent Basis of NNMI

President's Council of Advisors on Science and Technology



PCAST 2011
***Recommends Advanced
Manufacturing Initiative as national
innovation policy***



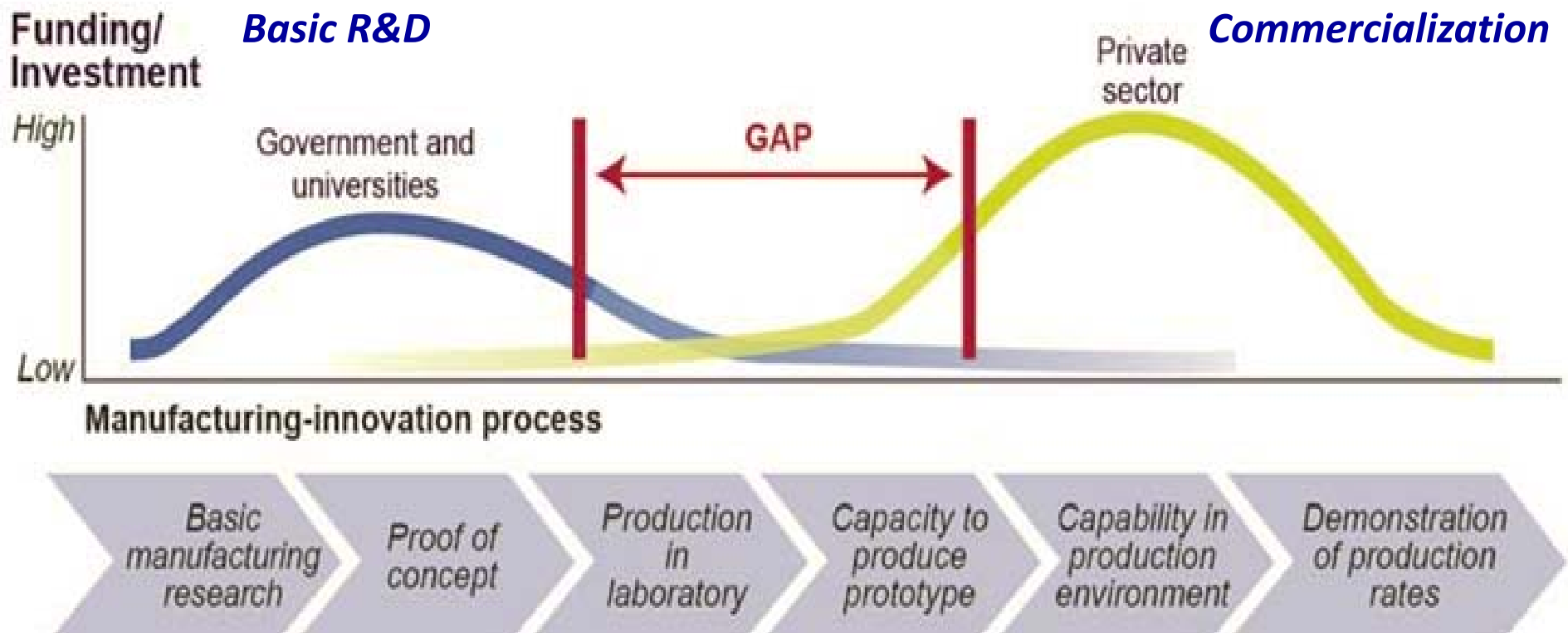
PCAST 2012
***Recommends Manufacturing
Innovation Institutes to address
key market failure***



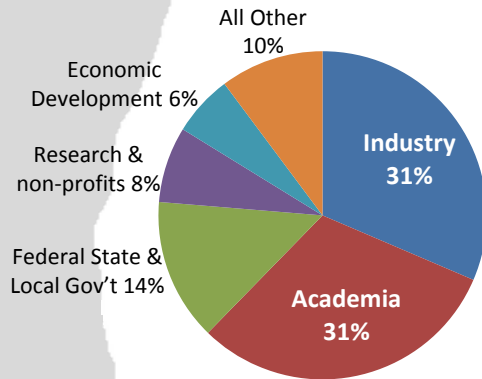
PCAST 2014
***Recommends strong, collaborative
network of Manufacturing
Innovation Institutes***

NNMI: Addressing the “Scale-up” Gap

Focus is to address market failure of insufficient industry R&D in the “missing middle” or “industrial commons” to de-risk promising new technologies



Public Engagement on Design Workshops & Request for Information



**Broad & Diverse Stakeholder Input
1,200 voices on the NNMI Design!**



**National Academies Beckman Center
Irvine California**



**University of Colorado
Boulder, Colorado**



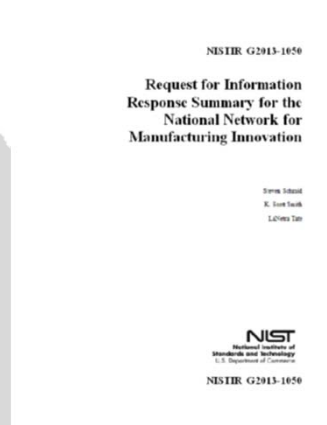
**Cuyahoga Community College
Cleveland Ohio**



**Rensselaer Polytechnic Institute
Troy New York**



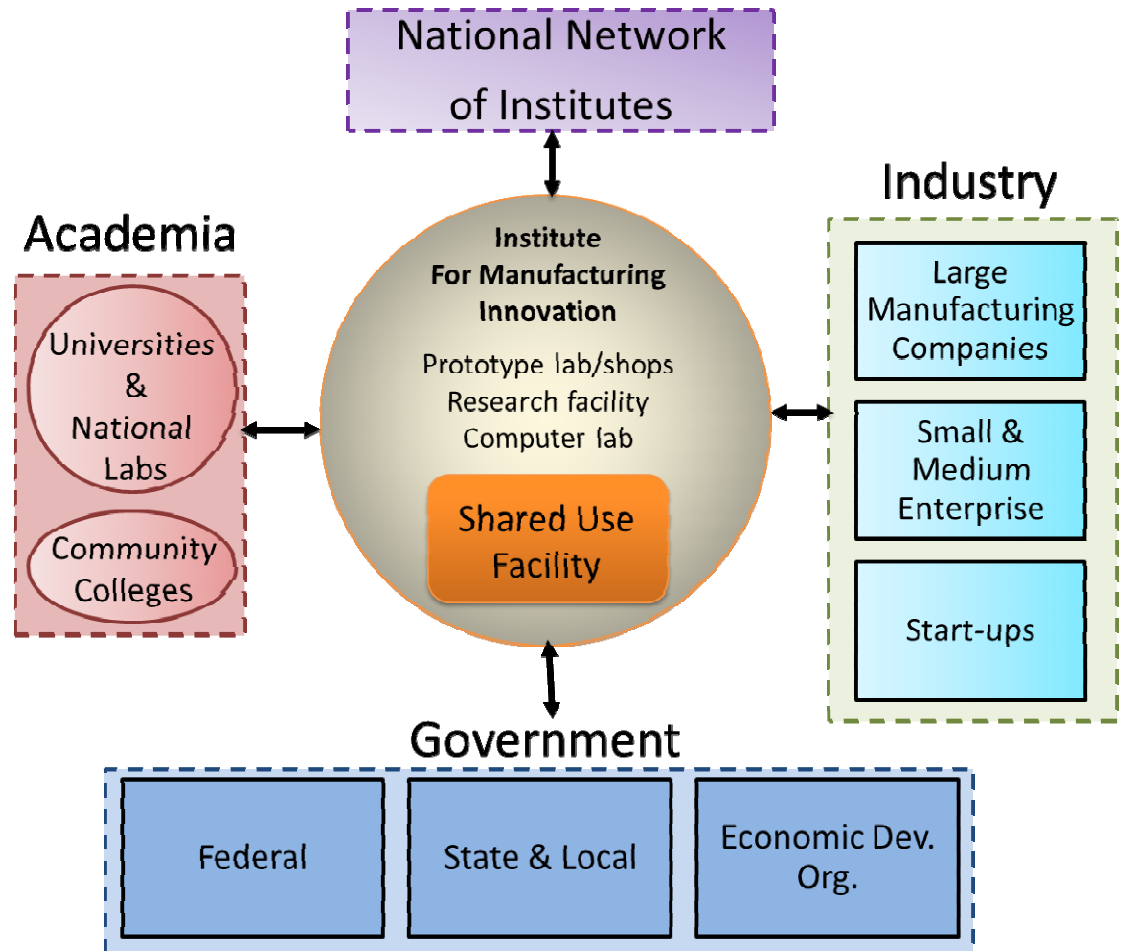
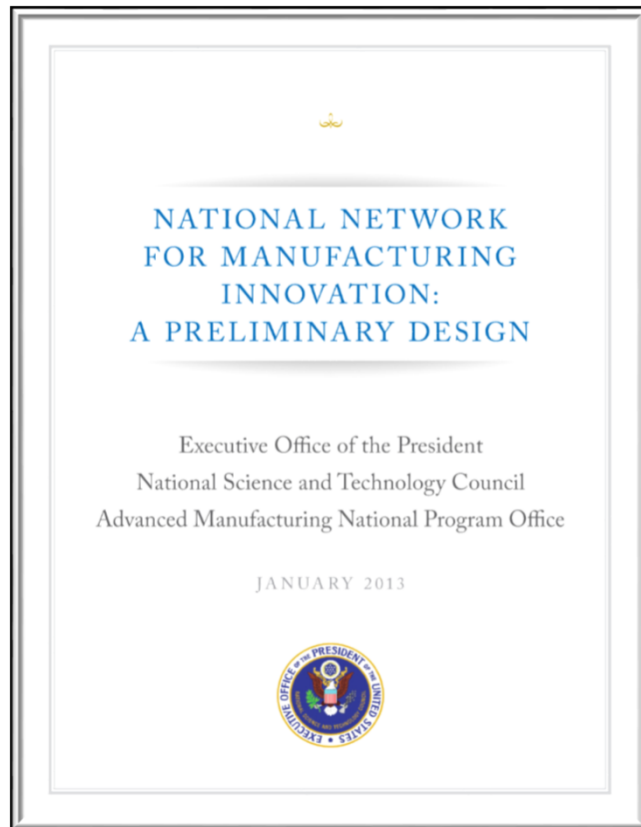
**U.S. Space and Rocket Center
Huntsville, Alabama**



The Institute Design

Creating the space for Industry & Academia to collaborate

White House Report
NNMI Framework Design
January 2013



The Institute Summary

Applied Research + Education/Workforce Skills + Development of Future “Manufacturing Hubs”

The Federal investment in the National Network for Manufacturing Innovation (NNMI) serves to create an effective manufacturing research infrastructure for U.S. industry and academia to solve industry-relevant problems. The NNMI will consist of linked Institutes for Manufacturing Innovation (IMIs) with common goals, but unique concentrations. In an IMI, industry, academia, and government partners leverage existing resources, collaborate, and co-invest to nurture manufacturing innovation and accelerate commercialization.

As sustainable manufacturing innovation hubs, IMIs 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.

Federal startup investment: \$70M - \$120M/institute over 5-7 years
Institute Consortium owners must have minimum 1:1 co-investment

The NNMI Mission

“The Network serves the Institutes, the Institutes connect through the Network, and the Program serves the Nation.”

Program Mission (Institutes + Network)

Advance American domestic manufacturing innovation by creating an effective manufacturing research and development infrastructure for U.S. industry and academia to solve industry-relevant problems.

Institute Mission

Create and strengthen American manufacturing hubs through sustainable industry-led innovation institutes that create, showcase, and deploy new capabilities.

Network Mission

Maximize the integrated impact of the manufacturing innovation institutes on U.S. manufacturing competitiveness.

NNMI Authorized: Revitalize American Manufacturing & Innovation Act



Rep. Tom Reed
R NY-23



Rep. Joe Kennedy
D MA-4



Sen. Sherrod Brown
D Ohio



Sen. Roy Blunt
R Missouri



September 15, 2014 –
Passed House
100 Cosponsors (51D, 49R)



December 11, 2014 –
Passed Senate with 2015 Appropriations
18 Cosponsors (10D, 7R, 1I)



December 16, 2014 –
Signed By President Obama

118 Bipartisan RAMI Bill Sponsors

Example Institute: Composites Manufacturing



Institute of Advanced Composites Manufacturing Innovation

Advanced Composites Institute Profile

IACMI, The Composites Institute
Knoxville, TN
Launched June 16, 2015

Agency sponsor: DOE
Startup funding: \$70M public,
\$159M co-investment

+344,000 square feet in five core regions
– composite manufacturing, laboratory,
instructional and collaboration space



1) Clear, unique Institute Focus

Each Institute has a clear mission based on a critical Industry need

Opportunity

Lightweight composites offer benefits to energy efficiency and renewable power generation, overcoming limitations through deployment of advanced technologies to make composite lower cost, faster, using less energy that can be readily recycled offer tremendous opportunities for US manufacturers.

Big Idea

The Institute will provide access to world-class resources to partner with industry and develop new low-cost, high-speed, and efficient manufacturing and recycling process technologies that will promote widespread use of advanced fiber-reinforced polymer composites.

At the new Institute, a world-class team of organizations from leading industrial manufacturers, material suppliers, software developers, government and academia will focus on lowering the overall manufacturing costs of advanced composites by 50 percent, reducing the energy used to make composites by 75 percent, and increasing the ability to recycle composites by more than 95 percent within the next decade.

2) Clear Industry Value Proposition

Each Institute creates value for industry participation and funding

- **Access to Shared RD&D Resources:** Leverage and provide access to equipment from lab to full-scale to enable demonstration and reduce risk for industry investment
- **Applied R&D:** Leverage significant government, industry, and academic investments to develop innovative solutions to member challenges
- **Composites Virtual Factory:** Provide access to end to end commercial modeling and simulation software for composite designers and manufacturers through a web based platform.
- **Workforce Training:** Provide specialized training to prepare current and future workforces for the latest manufacturing methods and technologies



3) Strong Private-Public Partnership

Each Institute is operated by a consortium; serving a partnership of Industry, Academia and government

A partnership of world-class companies including:



Top universities including:



Economic Development Council to leverage state support and investment



4) Addressing Critical Challenges

By workshops and Technology Roadmaps, Each Institute works on the industry priorities and big challenges only solvable by collaboration



Five/Ten Year Technical Goals

- 25/50% lower carbon fiber–reinforced polymer (CFRP) cost
- 50/75% reduction in CFRP embodied energy
- 80/95% composite recyclability into useful products



Impact Goals

- Enhanced energy productivity
- Reduced life cycle energy consumption
- Increased domestic production capacity
- Job growth and economic development

5) Balanced Portfolio of Projects

From Technology Roadmaps and Strategic Investment Plan, Each Institute manages a balanced portfolio of real projects for Industry

Activity	Result
1. First Projects Identified in proposal to DOE	<ul style="list-style-type: none">• Strengthen infrastructure capacity:<ul style="list-style-type: none">- Materials and processing- Modeling and simulation• Innovation and workforce development in strategic areas with national benefit:<ul style="list-style-type: none">- Automotive- Wind- Compressed gas storage
2. Technology Roadmap Driven by IACMI CTO, Industry and Technology Advisory Board	<ul style="list-style-type: none">• Identifies key hurdles to high -impact, large scale advanced composites manufacturing• Prioritizes opportunities across the materials and manufacturing supply chain
3. Strategic Investment Plan Driven by IACMI BOD and Technical Advisory Board	<ul style="list-style-type: none">• Changing the innovation cycle to enable rapid adoption and scale-up of advanced composites manufacturing
4. Open Project Call	<ul style="list-style-type: none">• Aligns with strategic investment plan and technology roadmap• Emphasis on projects with high near term impact.• Project Call- open NOW

Building the Network



America Makes
Additive
Manufacturing
DOD-Youngstown OH



DMDII
Digital Mfg & Design
Innovation
DOD – Chicago IL



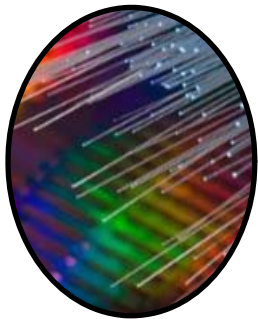
LIFT
Lightweight &
Modern Metals
DOD – Detroit MI



PowerAmerica
Power Electronics
Manufacturing
DOE – Raleigh NC



IACMI
Adv. Composites
Manufacturing
DOE – Knoxville TN



**Integrated
Photonics**
DOD-
Rochester NY



**Flexible Hybrid
Electronics**
DOD
Solicitation



**Smart
Manufacturing**
DOE
Award TBA



**Revolutionary
Fibers & Textiles**
DOD
Award TBA

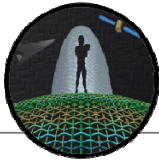


**Open-Topic
NIST
Solicitation**

Network Status and 2016 Plans

Future Network Goal: 45 Regional Hubs

Forthcoming Awards



Advanced Textiles



Smart Manufacturing



Flexible Hybrid Electronics
San Jose, CA



Additive Manufacturing
Youngstown, OH



Integrated Photonics
Rochester, NY

New Institutes Planned for 2016



Open topic competitions



Selected topic competitions supporting agency mission,
using agency authorities and budgets



Digital Manufacturing
& Design
Chicago, IL



Lightweight Metal
Manufacturing
Detroit, MI



Advanced
Fiber-Reinforced
Polymer Composites
Knoxville, TN



Wide Bandgap
Semiconductors
Raleigh, NC



What is new for FY2016?

Four initial Network functions, including:

- Establish the network ✓
 - November 2015 – Network meeting held at DMDII, Chicago, IL
 - June 2016 – Network meeting to be held in Washington, DC
- Facilitate value-added, intra-network collaboration
 - Shared Services being added in 2016 may include:
 - a secure online resource and toolkit that provides support and information for public and institute events,
 - bulletin board of government opportunities,
 - a handbook of best practices, network, and
 - a clearinghouse for inquires/visits
- Foster robust communication between the Network and external stakeholders, establish a public image



NIST Advanced Manufacturing Office

The Dept. of Commerce Sponsored Manufacturing Innovation Institutes



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

Commerce/NIST Institutes

Open-topic NNMI Institute Competition announced *February 19, 2016*

“These new institutes will help to improve the competitiveness of U.S. manufacturing and to fill the gap between basic research and commercialization.

They are uniquely positioned to accelerate non-federal investment in advanced manufacturing production capacity in the U.S. and to enable the commercial application of new technologies.”

Dr. Willie E. May

Under Secretary of Commerce for Standards and Technology
and NIST Director

NIST “Open-Topic” Competition

Uses new authorities under the Revitalize American Manufacturing and Innovation Act (RAMI) -

Applications will be accepted on **any topic** not covered by existing NNMI institutes or competitions in-progress

- Key attributes
 - **First.** Open-topic competition
 - **Each Institute.** One or more, each up to \$70 M federal share over 5 yrs. with option for up to 2 yr. extension
 - **Role.** Serve as a regional hub with its own well-defined focus area
 - **Two-step Process.** Pre-Applications then Invited Full Applications with each step to be open no less than 60-days

Visit the competition website at

<http://www.nist.gov/amo/nnmi/2016competition.cfm>

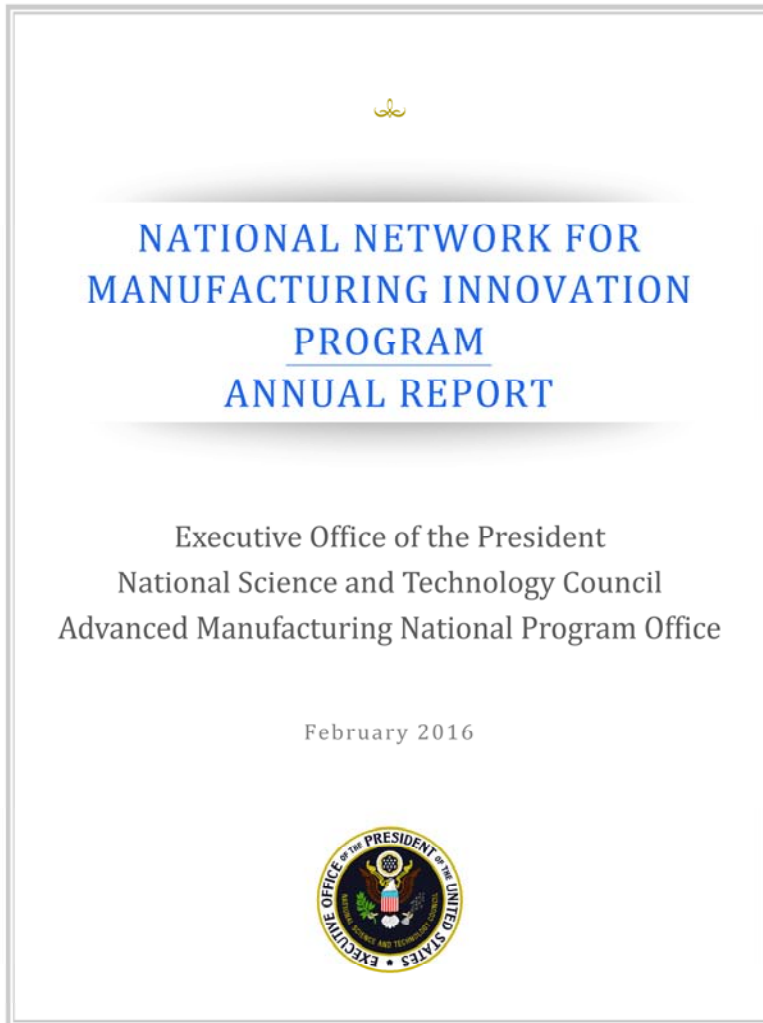
Commerce/NIST Institutes Key Competition Dates

Date	Event
<i>March 8, 2016</i>	<i>Proposers' Day</i>
<i>March 16, 2016</i>	<i>Webinar on NIST NNMI Competition: Resources, Templates, and FAQ's</i>
<i>April – December, 2016</i>	<i>Two-Stage competition</i>
<i>April 20, 2016</i>	<i>Pre-Applications due</i>
<i>Late May 2016</i>	<i>Invitations issued for Full Application submission</i>
<i>Early June 2016</i>	<i>Webinar on NIST NNMI Competition: Assembling a Budget</i>
<i>July 22, 2016</i>	<i>Full-Applications due</i>
<i>Early 2017</i>	<i>Award(s) announced</i>

NIST NNMI Proposers' Day

- March 8, 2016
- Familiarize potential applicants with the NIST Funding Opportunity and offered in three formats:
 - In-Person event held at NIST
 - Live webcast for those unable to travel
 - For those unable to attend either in-person or via webcast, they will be able to view a video recording of the event.
- In-person attendees *must* register by 3/2/2016. For more information, see: <http://www.nist.gov/amo/nnmi-proposers-day.cfm>

Released February 19, 2016 – NNMI Reports



**First Annual Report
on the NNMI Program**



**First Strategic Plan
on the NNMI Program**

NNMI: Enabling a Manufacturing Renaissance

Accelerating Discovery to Application to Production

- Establish a presence, at scale, in the “missing middle” of advanced manufacturing research
- Create an Industrial Commons, supporting future “manufacturing hubs”, with active partnering between all stakeholders
- Emphasize/support longer-term investments by industry
- Combine R&D with workforce development and training
- ***Overarching Objective: Unleash new U.S. advanced manufacturing capabilities and industries – for stronger global competitiveness and U.S. economic & national security***



Thank You! – How to connect

Advanced Manufacturing National Program Office

Phone: (301)-975-2830

Email: amnpo@nist.gov

Web: www.manufacturing.gov

DOC Open Topic Competition:

Phone: (301) 975-0404

Email: nnmifund@nist.gov

Website: www.nist.gov/amo/nnmi/2016competition

