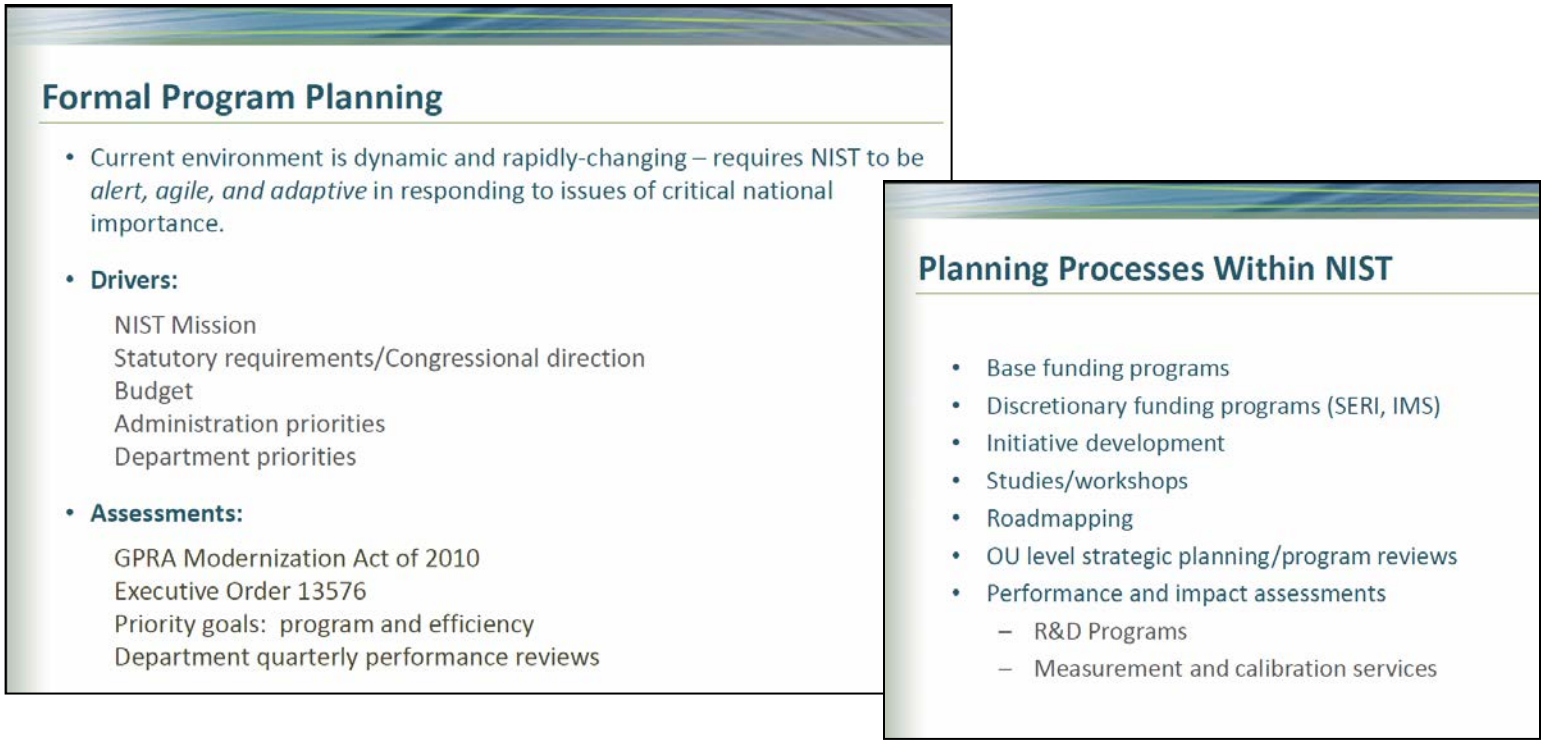
R&D Planning at NIST

Visiting Committee on Advanced Technology
June 19-20, 2012

Dr. Willie E. May

Associate Director for Laboratory Programs and Principal Deputy

During our February 2012 VCAT meeting, aspects of NIST planning were briefly presented during the Director's NIST Overview:



Today, I'd like to continue that conversation …

Discussion Topics

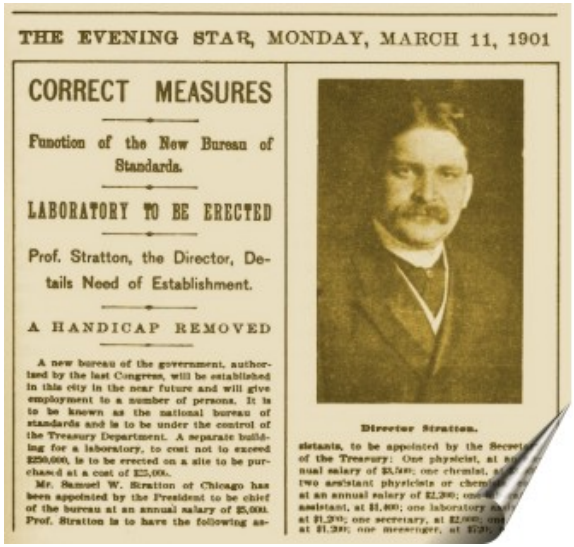
- The Planning Environment at NIST - *A Unique Federal Agency*
- Overview of current priorities and resource alignment
- New Organizational Structure and how it facilitates better planning
- Roles of NIST Director, Associate Director for Laboratory Programs, and Laboratory Directors in Planning and Resource Allocation
- Steps being taken to strengthen planning at NIST
- Assessment of our Laboratory Program

NIST (NBS) established in 1901

"It is therefore the unanimous opinion of your committee that no more essential aid could be given to

- **manufacturing**
- **commerce**
- **the makers of scientific apparatus**
- **the scientific work of Government**
- **schools, colleges, and universities**

than by the establishment of the institution proposed in this bill."



THE EVENING STAR, MONDAY, MARCH 11, 1901

CORRECT MEASURES

Function of the New Bureau of Standards.

LABORATORY TO BE ERECTED

Prof. Stratton, the Director, Details Need of Establishment.

A HANDICAP REMOVED

A new bureau of the government, authorized by the last Congress, will be established in this city in the near future and will give employment to a number of persons. It is to be known as the national bureau of standards and is to be under the control of the Treasury Department. A separate building for a laboratory, to cost not to exceed $250,000, is to be erected on a site to be purchased at a cost of $25,000.

Mr. Samuel W. Stratton of Chicago has been appointed by the President to be chief of the bureau at an annual salary of $5,000. Prof. Stratton is to have the following as-

Director Stratton.

sistants, to be appointed by the Secretary of the Treasury: One physicist, at [illegible] annual salary of $3,500; one chemist, at [illegible] two assistant physicists or chemists, at an annual salary of $2,250; one assistant, at $1,400; one laboratory [illegible] at $1,200; one secretary, at $2,000; one at $1,200; one messenger, at $720.

House Committee on Coinage, Weights and Measures … on the establishment of the National Bureau of Standards (now NIST)
May 3, 1900

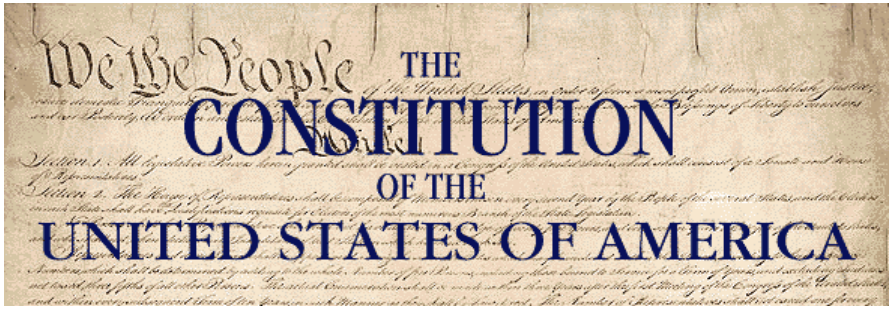
Organic Act of 1901; Updated in 2008

Functions and activities of the Institute include:

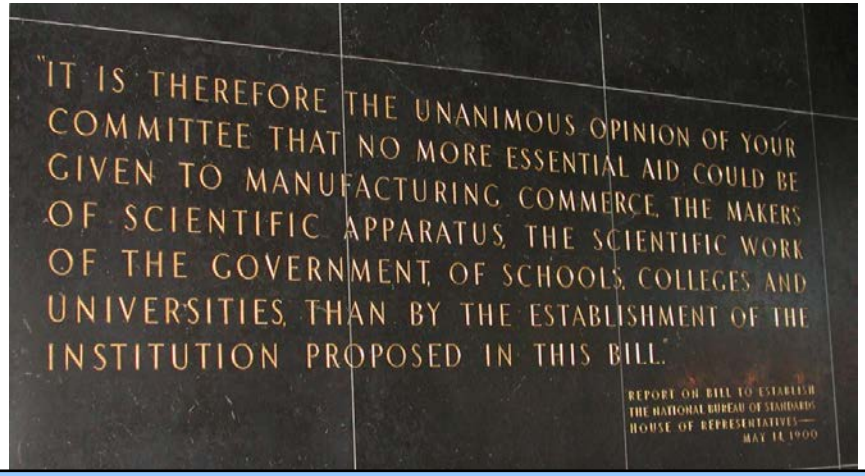
- **custody and dissemination of national standards.**
- **determination of physical constants and the properties of materials,**
- **comparison of US national standards with those of other nations**
- **solutions to measurement and standards problems of other government agencies**
- **providing (Innovation) assistance to industry**

National Institute of Standards and Technology (NIST)

- Non-regulatory agency within U.S. Department of Commerce
- Founded in 1901 as National Bureau of Standards



Article I, Section 8: The Congress shall have the power to …*coin money, regulate the value thereof, and of foreign coin, and fix the standard of weights and measures*



***Unique Mission within the Federal Government* …**

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

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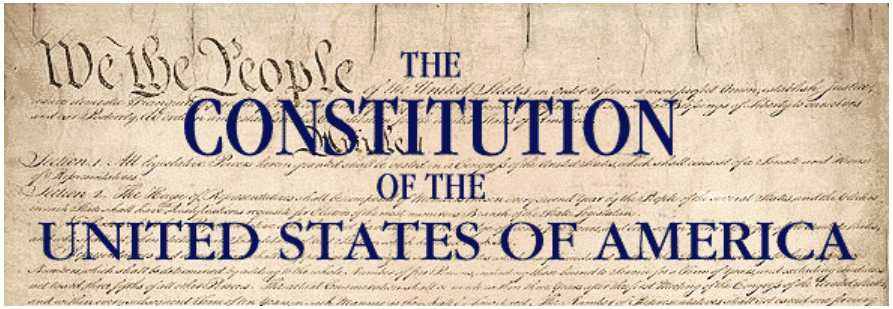

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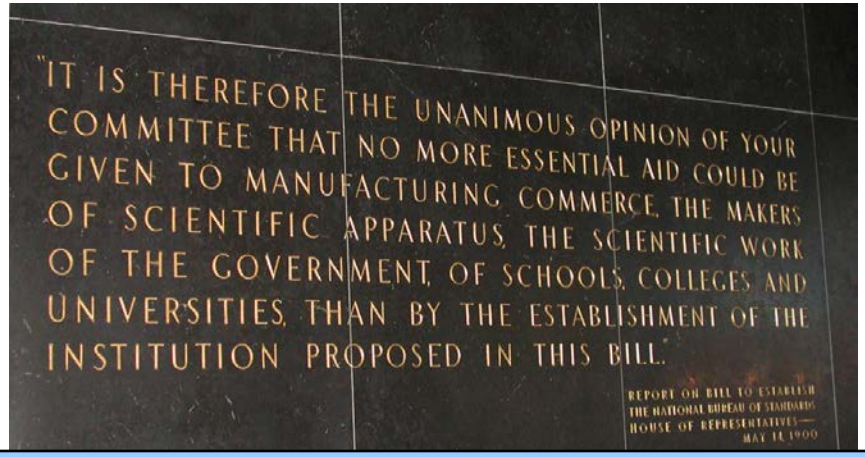
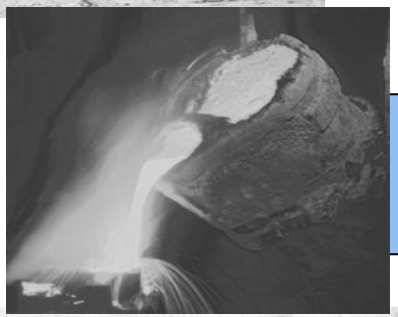


- **Deep research expertise underpins technological innovation** – e.g., new materials, advanced clinical diagnostics and therapies, advanced communications, etc.
- **Non-regulatory status** enables important role as a convener that facilitates collaboration between industry and government

Since our inception, in addition to maintaining the more traditional National physical standards, **we have also focused a significant portion of our research and measurement services activities on addressing contemporary societal needs.**



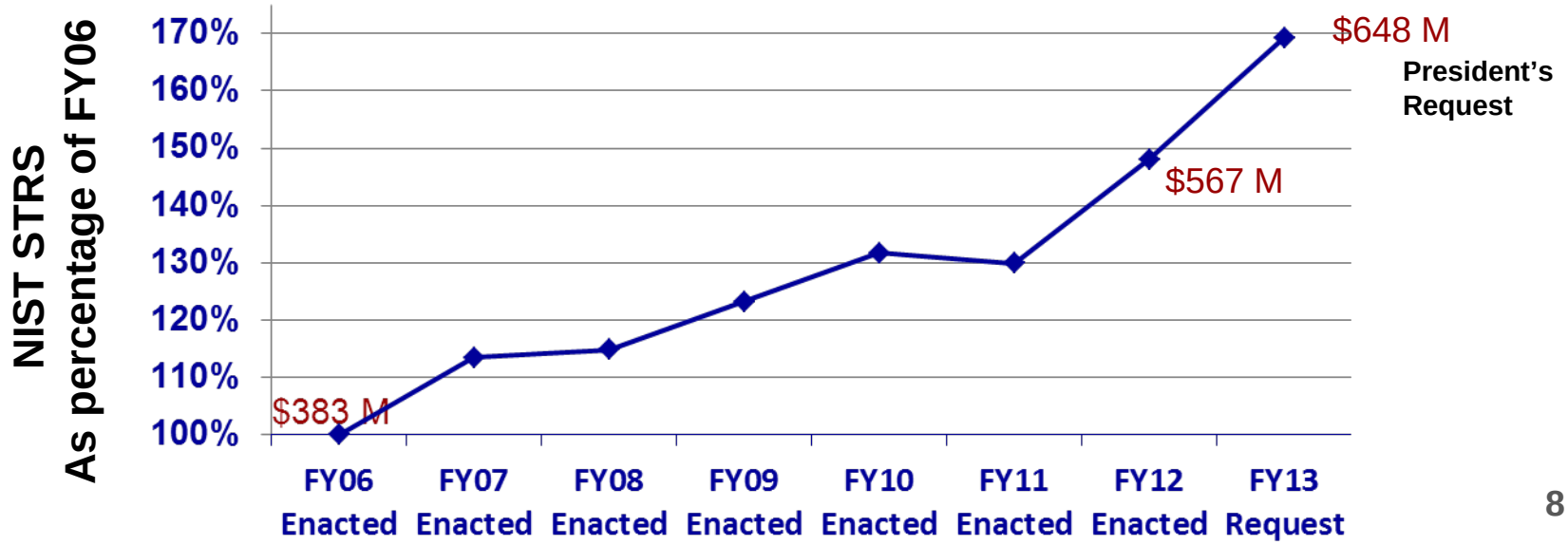
2012

NIST Strategic Investment Priorities

- Advanced Manufacturing
- Advanced Materials
- the Environment and Consumer Safety
- Energy
- Bioscience and Health
- Information Technology & Cybersecurity
- Physical Infrastructure
- Forensics & Homeland Security

U.S. Innovation Agenda – NIST has an increasing role

Both the American Competitiveness Initiative & the America COMPETES Act called for substantially increased funding for NIST laboratory Programs



New NIST Structure and Planning Environment

- **How does NIST do strategic planning?**
- **How does NIST couple its existing base funds with new funds (through initiatives) to develop programs with maximum impact?**
- **How does NIST address new opportunities, build staff competency in new areas and adapt to new budgets and unfunded external mandates**
- **How does NIST plan so both its strategic focus areas and core competencies “stay relevant” and effective**

NIST Planning "Environment"

NIST has the unique mission within the Federal Government: ***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***

- Drivers for our planning include the Science and Technology Priorities from:
  - each **Congress**
  - each **Administration**
  - **industry**
  - other **Federal Agencies**

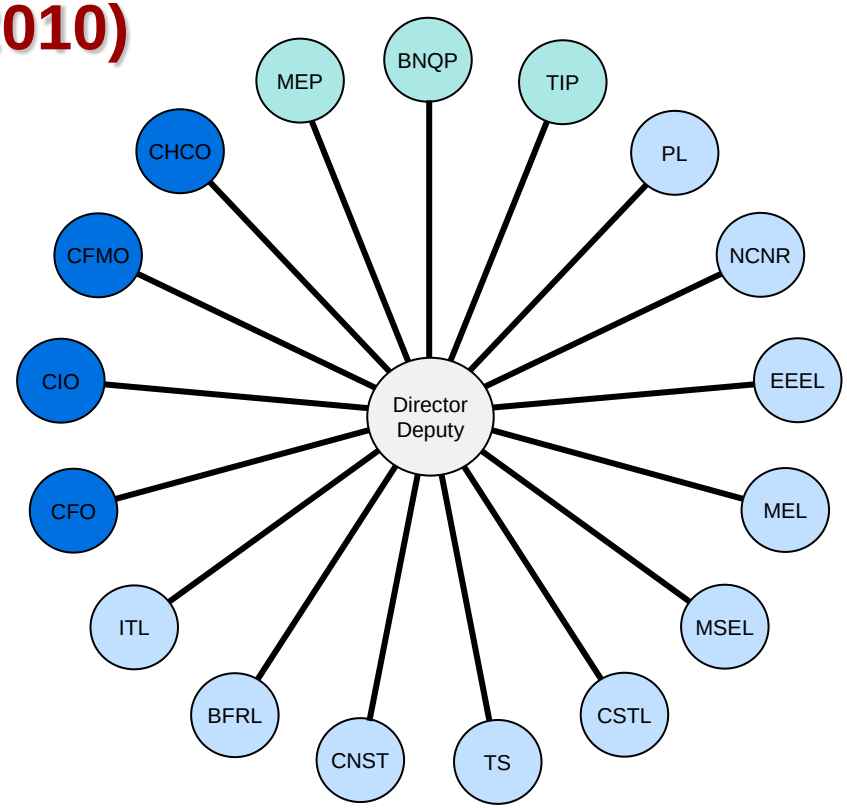
  To prioritize AMONG these various external priorities, NIST planning includes a combination of internal top-down, middle-driven, and bottoms up input

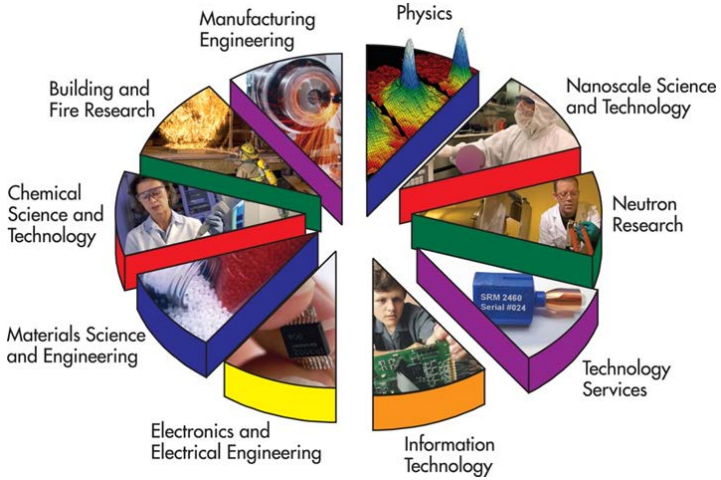
- Uncertainty of the Federal Budget process
  - Very seldom get budget at beginning of FY
  - Always working on three budgets at same time

- Due to our unique mission and broad responsibilities, effective planning at NIST cannot mimic other scientific laboratory-based organizations. Although we have some common attributes, **NIST is not:**
  - a for-profit private sector organization (e.g., former Bell Labs)
  - a contract research lab (e.g., Battelle, Southwest Research)
  - an academic institution (e.g., Colorado, Duke, Stanford, UMD)
  - a regulatory agency (such as EPA, FDA, FCC, …)
  - an extramural funding Agency (such as NSF)

Our broad mission and the dynamic environment we live in requires us to be alert, be adaptive and develop and maintain a robust and agile R&D program

NIST (circa 1992 – 2010)





Congressional Appropriations provided as Line Items for various scientific disciplines

New NIST Organizational Structure

NIST Director is:

- responsible for Agency Policies and Priorities
- directs the Development and Execution of NIST's Scientific, Technical, Innovation, Industrial and Administrative Programs within guidelines set by the Secretary of Commerce
  - is assisted in this role by:
    - The **ADLP** who serves as Principal Deputy to the Director, assists in the overall direction of NIST and has specific responsibility for the Laboratory Program
    - The **ADMR** who assists in the direction of NIST by managing and carrying out administrative and technical infrastructure and support programs essential for daily operations throughout NIST.
    - The **ADIIS** who serves as the principal executive and advisor to the Director on all matters related to NIST's innovation and industry services programs

New NIST Organizational Structure

Director
Under Secretary of Commerce for Standards and Technology
Patrick D. Gallagher

Executive Officer for Administration
Management and Organization
Administrative Support

Chief of Staff
Program Coordination
Public and Business Affairs
Congressional and Legislative Affairs
International and Academic Affairs

Associate Director for Laboratory Programs/Principal Deputy
Willie E. May

Standards Coordination Office
Special Programs Office

Material Measurement Laboratory
Laurie E. Locascio
Physical Measurement Laboratory
Katharine B. Gebbie
Engineering Laboratory
S. Shyam-Sunder
Information Technology Laboratory
Charles H. Romine
Center for Nanoscale Science and Technology
Robert Celotta
NIST Center for Neutron Research
Robert M. Dimeo

Associate Director for Innovation and Industry Services
Phillip A. Singerman

Technology Partnerships
Economic Analysis
Grants Management

Baldrige Performance Excellence Program
Harry S. Hertz
Hollings Manufacturing Extension Partnership
Roger D. Kilmer
Technology Innovation Program
vacant

Associate Director for Management Resources
David Robinson

Boulder Site Management
Civil Rights and Diversity
Research Support Services
Strategic Resources

Office of Facilities and Property Management
Stella S. Fiotes
Office of Financial Resource Management
George E. Jenkins
Office of Workforce Management
Susanne K. Porch
Office of Information Systems Management
Delwin Brockett
Office of Safety, Health and Environment
Richard F. Kayser

New NIST Organizational Structure

Improves the efficiency and effectiveness of NIST in realizing its mission by:

- strengthening and stabilizing the Director's Office by establishing a core Senior Career Leadership Team
- facilitating better coupling of "corporate level" strategic planning with agile R&D planning within each Laboratory
- better integration of research and measurement service activities
- facilitating a stronger client-service model between the Management Resource Functions & the NIST Labs in carrying out the "Business of NIST"

“Plans for Planning” in New Organizational Structure

1. **Implementation of clearly defined organizational roles and responsibilities for NIST Leadership**

2. Use of various diverse fiscal resources to direct an agile research program to maximize its effectiveness in support of NIST’s mission

3. Better integration of NIST wide and OU level Planning efforts

Roles and Responsibilities in Planning

- **Strategic Planning for the NIST Laboratory Program**
  - Identify and garner support for Strategic Focus Areas over a 3 to 4 year horizon
    - **led by ADLP** with assistance f rom PCO and Lab Directors

- **R&D Planning and Capacity Building in the NIST Labs**
  - Maintain the scientific foundation/core competencies required to support the NIST mission in a constantly changing environment ; ongoing, but looking forward 5-10 years
    - **Responsibility of Laboratory Directors** in each of their respective sub-mission areas

The Associate Director for Laboratory Programs (ADLP)

as Principal Deputy to the Director, assists in the overall direction of NIST and ***has specific responsibility for***

- **direction and operational guidance for the laboratory programs, including**
  - *program and budget development*
  - *allocation of Laboratory Program resources:*
    - *laboratory base*
    - *budget initiatives*
    - *short term discretionary nonbase*
  - *oversight of the delivery of measurement services to meet the needs of industry, academia, and other government agencies*
- **representing and describing the NIST Laboratory Program to external audiences**

Laboratory Directors

In their role as members of the Leadership Team, ***assist and work with the ADLP to ensure the health and effectiveness of NIST Laboratory Program Activities***

The Laboratory Directors have specific responsibility *-- within their assigned Sub Mission Space --* ***for***

- establishing and maintaining an effective R&D program with the agility to respond to current and future measurement, standards and technology needs
- responsible stewardship and accountability of entrusted resources
- effective implementation of the programs/projects of the Laboratory
- delivery of measurement services to meet the measurement standards and technology needs
- representing and describing their Laboratory program to internal and external audiences

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Scientific and Technical Research and Services (STRS)

Congressionally-Appropriated Funds for Lab Program

- **Laboratory Base Funds:** Support for long term R&D capacity building and maintenance
- **Budget Initiatives:** Base Augmentation from Congress to support new NIST programs; typically $2.0 to $20 M/yr

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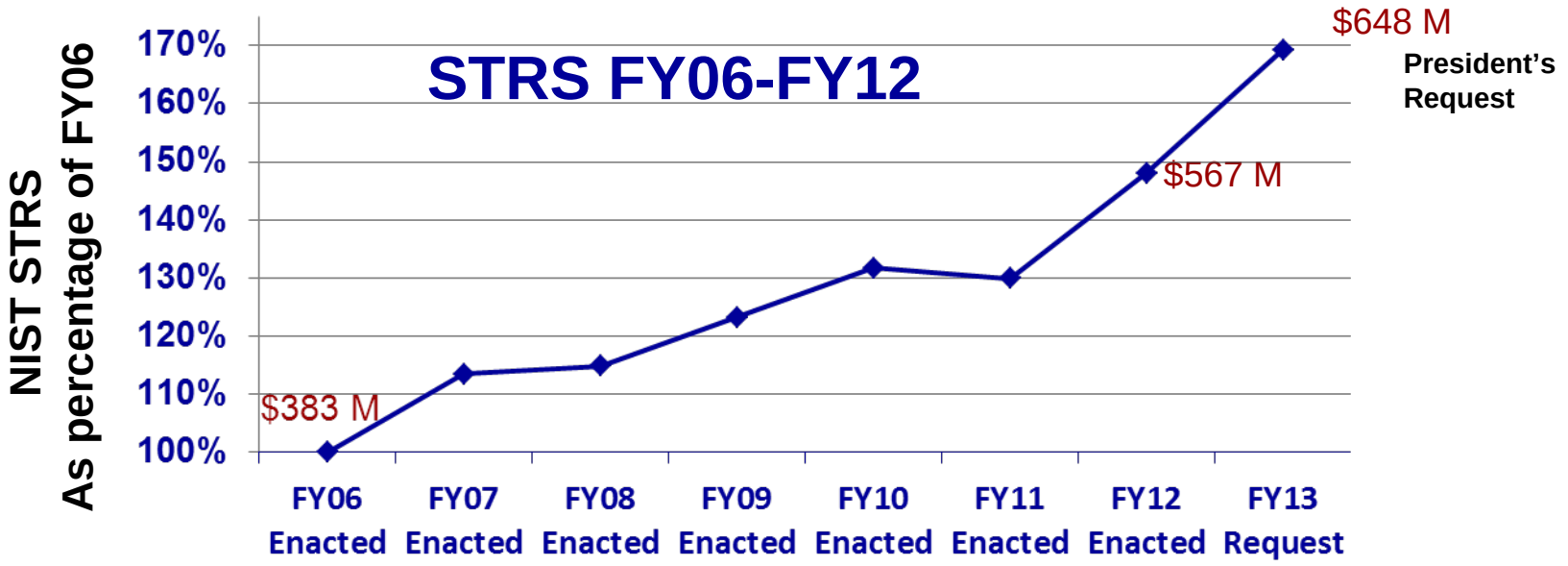
- **Strategic and Emerging Research Initiatives (SERI):** 1 to 3 yr term funding (currently $5.7M) from the NIST annual appropriation for specific projects to
  - jump-start efforts in selected new proposed initiative areas
  - support “unfunded mandates” from the Administration or Congress
  - augment current underfunded new initiatives
- **Innovations in Measurement Science (IMS):** 3-5 yr term funding (from $22 M revolving fund) for innovative and creative ideas from NIST scientists and engineers
  - bottom-up input
  - $0.25 to 1.5 M/yr per award
- **Director’s Reserve:** 1-yr term funding from prior year carryover for short-term program needs within a given OU



Base Growth by Focus Area (2006 - 2012)

	$ Millions
• Advanced Manufacturing	+ 24.8
• Advanced Materials	+ 4.0
• Bioscience and Health	+ 14.7
• Cybersecurity and IT	+ 39.0
• Energy	+ 21.2
• Greenhouse Gas Measurement	+ 15.2
• Measurement Science/Service	+ 9.0
• Nanotechnology	+ 17.8
• NCNR capacity increase	+ 16.3
• Physical Infrastructure and Construction	+ 12.4
• Quantum Science	+ 10.8
• STEM Activities	+ 3.0

FY12 Appropriated Funds for NIST R&D

FY2012 Enacted

STRS	**$567.0 M**
– Laboratory Programs	518.0
– Corporate Services	18.5
– Stds Coord. and Spec. Programs	30.5

Laboratory Program STRS	**$518.0 M**
National measurement and standards laboratories	424.74
User Facilities (CNST and NCNR)	74.56
Strategic and emerging research initiative fund	5.67
Postdoctoral Research Associateship Program	13.00

Portfolio of NIST Laboratories STRS

Goal: Establish a snapshot of the NIST Lab Program STRS Portfolio (investment profile)

Process:

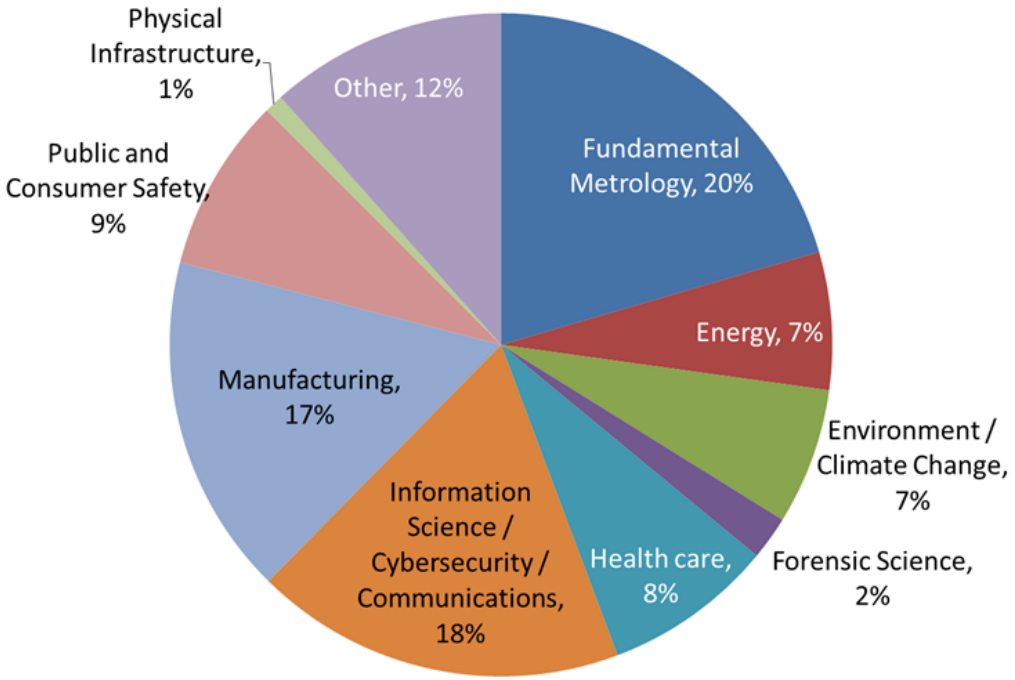
- The funds of each Laboratory STRS cost center (project) were allocated by the relevant lab among 10 specified "bins" (i.e., funds could be attributed to 1 category, or 2 or 3 …..
  - there was no "double counting".
- For each project, Labs provided a brief text description of the focus and expected outputs of project activities for each funded bin

Status:

Currently undergoing review and quality assurance

Caveats:

- These data are "one snapshot in time"
- Some activities fit equally into more than one category, *e.g., Healthcare IT could have been put in Healthcare or in Information Science; in the guidelines provided, Labs were told to put these activities under Healthcare*



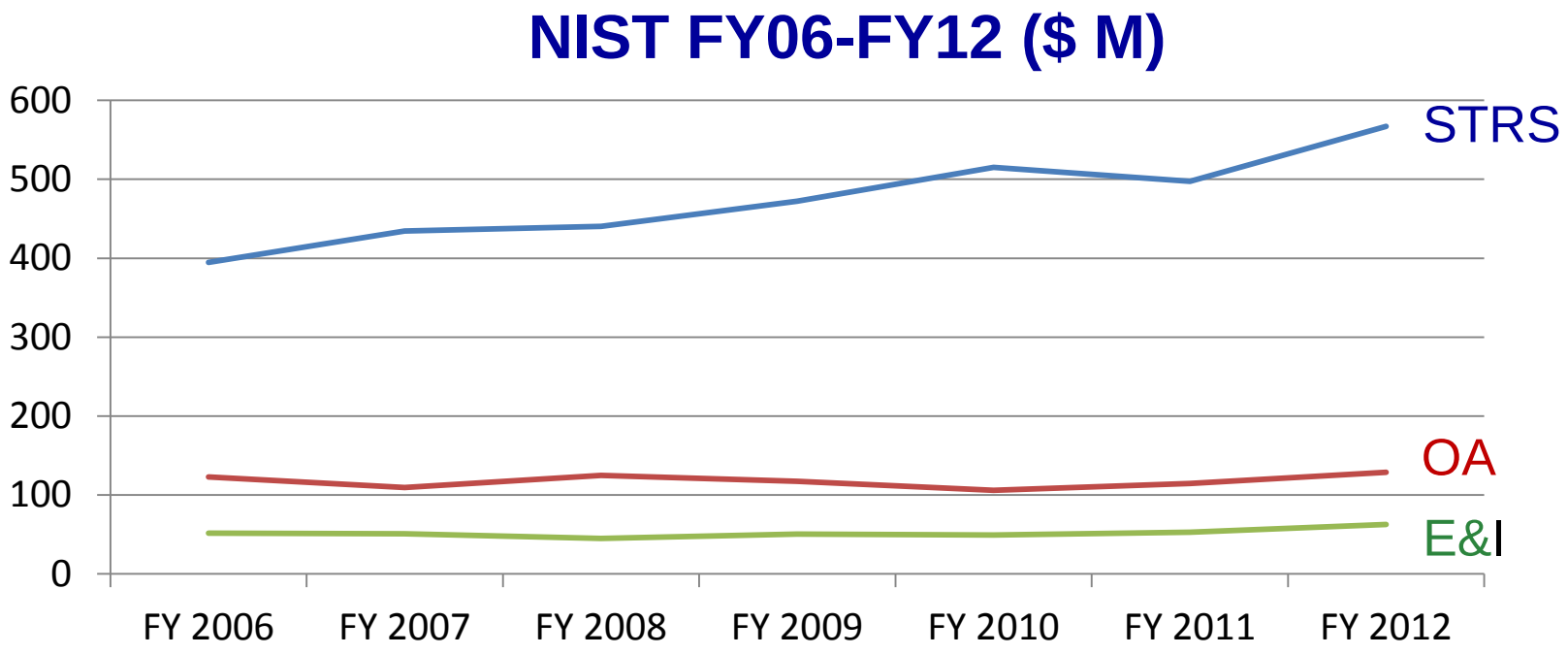
FY12 STRS appropriation increased $69.6M over FY11

- **Congressionally Mandated Allocation** **$ M**
  - National Cybersecurity Center of Excellence: + $ 10.0
  - Support for NSTIC + $ 16.5

- **Remaining +$43.1M allocated at NIST Director's Discretion, guided by NIST 3-year Plan**
  - **$19M to support manufacturing-related activities**
    - Advanced Materials for Industry (Materials Genome) (MML) $ 4.0
    - Innovation for 21st Century Manufacturing (EL) $ 4.0
    - Biomanufacturing (MML) $ 4.0
    - Nanomanufacturing $ 7.0
    - Nano Fab recap (CNST) $ 5.0
    - Nano EHS (MML, PML, EL) $ 2.0
  - **Cloud Computing and Wireless Interoperability research** (ITL) $ 3.8
  - **Strengthening Meas. Services in time & electrical measurements** (PML) $ 5.0
  - **Advanced Infrastructure and Resilience—Adv. Fire Lab** (EL) $ 2.0
  - **Net-Zero Energy Buildings Initiative** – (EL) $ 2.5
  - **Expansion of NIST Post Doc program** $ 2.0
  - **ADLP nonbase reserve** $ 8.8

Other Sources of Income

- Research and Measurement Services for Other Government Agencies (OA)
- Reimbursable Services provided through SRMs, calibration and testing services, reference data, Laboratory Accreditations, etc. (E&I)



OA and E&I estimates for FY2012; others actual

“Plans for Planning” in New Organizational Structure

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3. **Better integration of NIST wide and OU level Planning efforts**

Planning Processes

- ☑ discussed the roles/functions of the ADLP and the Laboratory Directors
- ☑ discussed the availability of funds as relevant to R&D
- ❑ **Planning Process**

  How does NIST decide "which mountains to climb (or continue climbing)"?

  How do we best allocate our resources (fiscal, staff, facilities, …) among these?

  - **We are in the second year of our realigned organization structure**
    - For FY11&12, the historical allocation was basis for allocating STRS base to the Laboratories
    - Operational processes are being discussed and implemented for enhanced, coordinated, strategic planning at the NIST "Corporate Level" with that among the Laboratories and within each Laboratory
    - An LP Offsite was held in which each Laboratory Program Director presented an overview of the R&D planning processes currently used in that Laboratory
    - For new FY12 Initiative funding, Program Plans and Spend Plans for each were prepared and reviewed.

R&D Planning for Laboratory Activities

- **Drivers**
  - Administration and Congressional Priorities
  - Industry needs and trends
  - Trends and developments in academia
  - Needs of other federal/governmental agencies

- **Inputs**
  - Workshops
  - Advisory Boards
  - Planning Studies
  - Program Reviews and Assessments
  - Market Analysis and Investment Data

- **Planning Outputs**
  - OU R&D Plans
  - Equipment and Facilities needs
  - Input to Budget Initiatives

Steps Taken to Better Couple NIST and OU Planning Processes

- Over the past several years NIST has done a better job of defining investment priority areas and developing and updating multiyear programmatic plans in each of these areas
  - improved multi-OU coordination
  - enabled a more agile planning posture given the heightened uncertainty of recent years.

- This past fiscal year NIST instituted OU business plan reviews, and spend plan reviews for all new Initiative activities launched in FY12.
  - planning for end-of-year progress reviews is underway

- Formalization and standardization of these efforts is an ongoing process; NIST is working to establish an integrated process that encompasses both short (0-3 year) strategic planning and longer range R&D planning (to provide the cutting edge measurement science capabilities to support programmatic thrusts).

Assessment

- Assessment is a critical element of both planning and management.
  - How can NIST be more effective in meeting its mission?
  - Are we “choosing the right mountains” to climb?
  - Is the quality of our technical research appropriate?
  - Are we successfully maintaining existing core competencies still needed and developing new ones needed to support our Mission?
  - How is our performance, our relevance, and the impact of our work?
  - What are our weaknesses? Vulnerabilities?

- Establishing appropriate metrics and assessment tools is complex.

- Need a balance among planning, implementation, and assessment.

Thanks for Your Attention

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Questions and Comments?