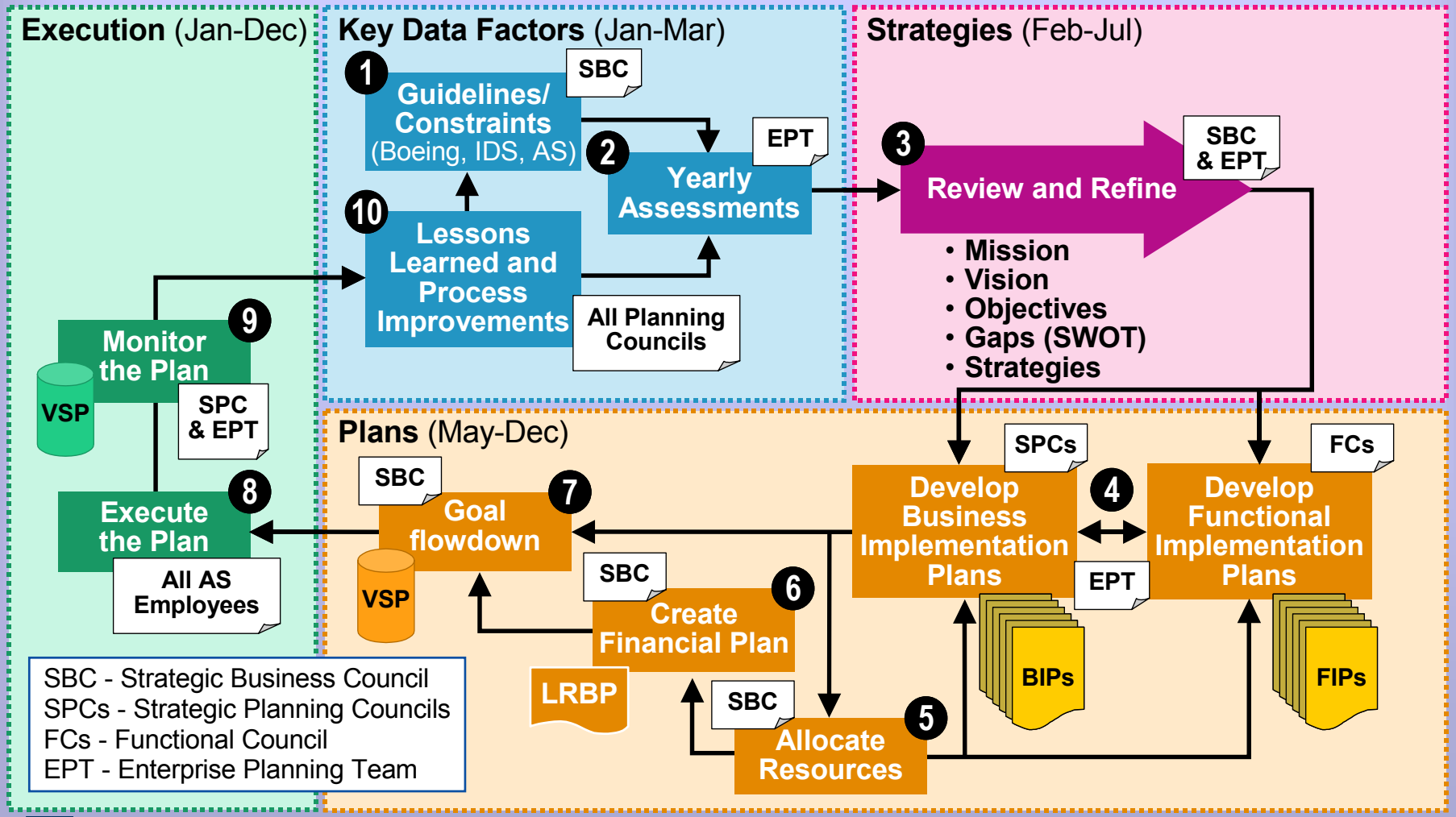
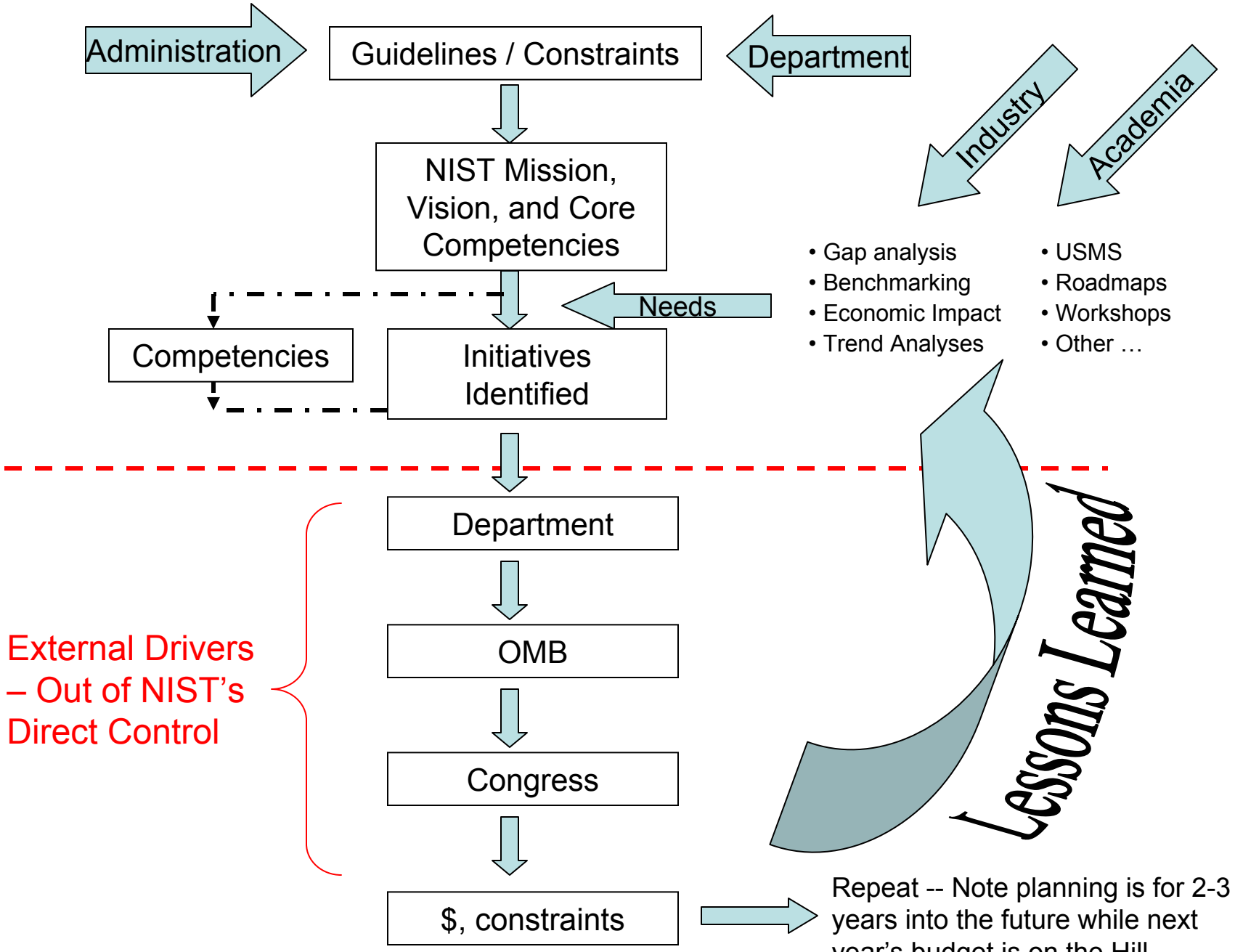
NIST Planning Process:
Overview and Future Direction

4. Enterprise Planning Process
10 Defined Steps

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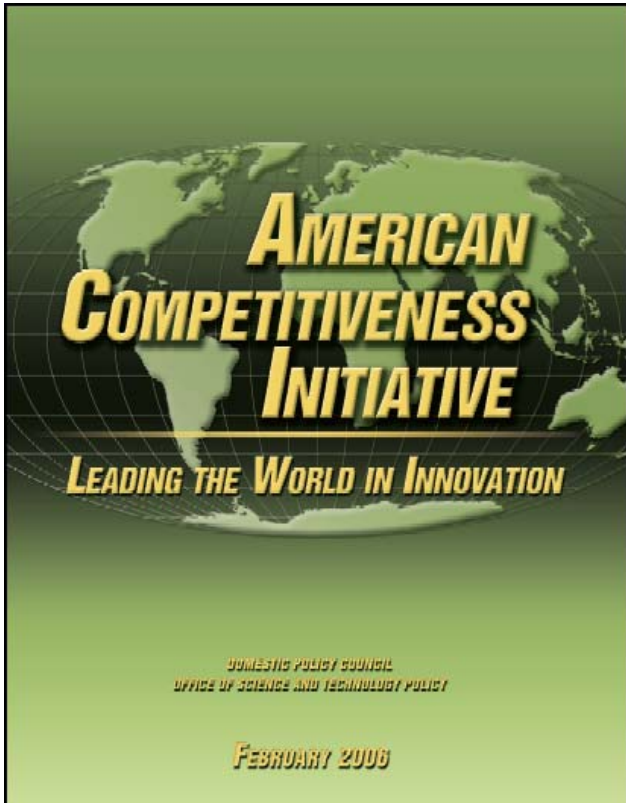


The role of government is not to create wealth. The role of our government is to create an environment in which the entrepreneur can flourish, in which minds can expand, in which technologies can reach new frontiers.

GOALS FOR ACI RESEARCH

While expected new innovations are impossible to predict with specificity, certain capabilities and technology platforms can be anticipated as a result of the ACI:

- World-class capability and capacity in nanofabrication and nanomanufacturing that will help transform current laboratory science into a broad range of new industrial applications for virtually every sector of commerce, including telecommunications, computing, electronics, health care, and national security (NSF, DoE, NIST)
- Chemical, biological, optical, and electronic materials breakthroughs critical to cutting-edge research in nanotechnology, biotechnology, alternative energy, and the hydrogen economy through essential infrastructure such as the National Synchrotron Light Source II and the NIST Center for Neutron Research (DoE, NIST)
- World-leading high-end computing capability (at the petascale) and capacity, coupled with advanced networking, to enable scientific advancement through modeling and simulation at unprecedented scale and complexity across a broad range of scientific disciplines and important to areas such as intelligent manufacturing, accurate weather and climate prediction, and design of safe and effective pharmaceuticals (NSF, DoE)
- Overcoming technological barriers to the practical use of quantum information processing to revolutionize fields of secure communications, as well as quantum mechanics simulations used in physics, chemistry, biology, and materials science (DoE, NIST, NSF)
- Overcoming technological barriers to efficient and economic use of hydrogen, nuclear, and solar energy through new basic research approaches in materials science (DoE, NSF, NIST)
- Addressing gaps and needs in cyber security and information assurance to protect our IT-dependent economy from both deliberate and unintentional disruption, and to lead the world in intellectual property protection and control (NSF, NIST)
- Improvement of sensor and detection capabilities that will result in world-leading automation and control technologies with a broad range of applications important to areas such as national security, health care, energy, and manufacturing (NSF)
- Development of manufacturing standards for the supply chain to advance and accelerate the development and integration of more efficient production practices (NIST)
- Enhanced response to international standards challenges, which impact U.S. competitiveness and limit export opportunities for American businesses by acting as technical barriers to trade (NIST)
- Accelerated work on advanced standards for new technologies (NIST)
- Advances in materials science and engineering to develop technologies and standards for improving structural performance during hazardous events such as earthquakes and hurricanes (NIST, NSF)
- Improving capacity, maintenance, and operations of DoE and NIST labs

DRAFT

National Science and Technology Council

DRAFT

Committee on Environment & Natural Resources

Sharon Hays, EOP
Conrad Lautenbacher, Commerce
George Gray, EPA

- Global Change Research (SC)
- Air Quality Research (SC)
- Disaster Reduction (SC)
- Ecosystems (SC)
- Toxics and Risks (SC)
- Water Availability and Quality, (SC)
- US Group on Earth Observations (SC)
- Dioxin (IWG)
- Oceans Science and Technology (SC)

Committee on Science

Sharon Hays, EOP
Arden Bement, NSF
Elias Zerhouni, NIH

- Research Business Models (SC)
- Education and Workforce Dev. (SC)
- Aquaculture (SC)
- Human Subjects Research (SC)
- Physics of the Universe (IWG)
- Domestic Animal Genomics (IWG)
- Prion Science (IWG)
- Trans-border Samples (IWG)
- Scientific Collections (IWG)
- Food and Ag Research (TG)
- Plant Genome (IWG)
- Overweight and Obesity Res. (IWG)
- Social, Behavioral, Economic (SC)

Committee on Technology

Richard Russell, EOP
William Jeffrey, Commerce

- Networking and Information Technology (NITRD) (SC)
- Nanoscale Science, Engineering And Technology (NSET) (SC)
- Manufacturing R&D (IWG)
- Aeronautics S&T (SC)
- Hydrogen (IWG)
- Biometrics (SC)
- Infrastructure (SC)
- Biotechnology (SC)
- Export Controls for S&T (TG)

Committee on Homeland and National Security

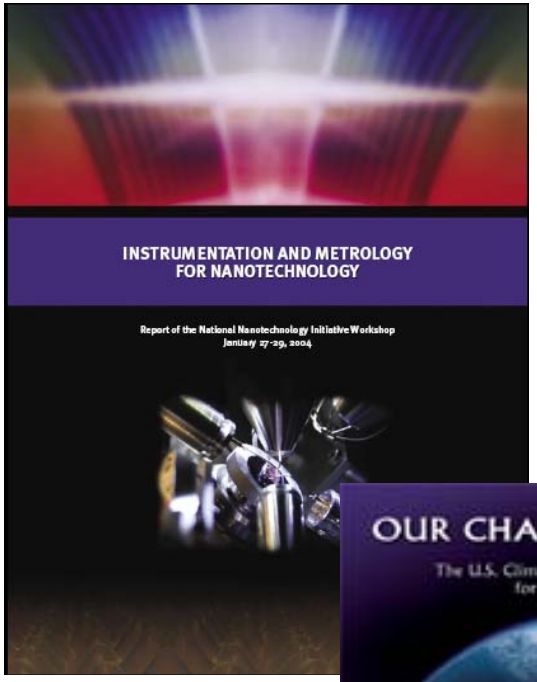
Sharon Hays, EOP
Ken Kreig, DoD
TBD, DHS

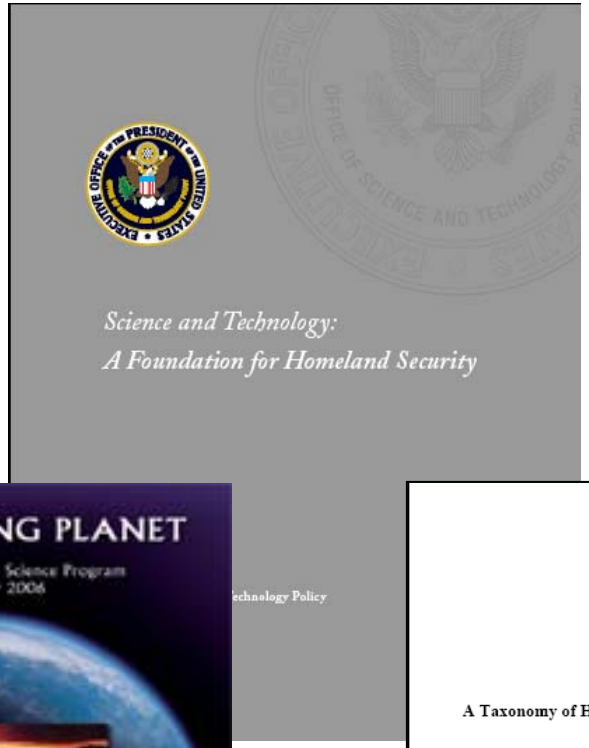
- National Security R&D (SC)
- International (SC)
- WMD Medical Countermeasures (SC)
- Decontamination Standards And Technologies (SC)
- Foreign Animal Disease Threat (SC)
- Standards (SC)

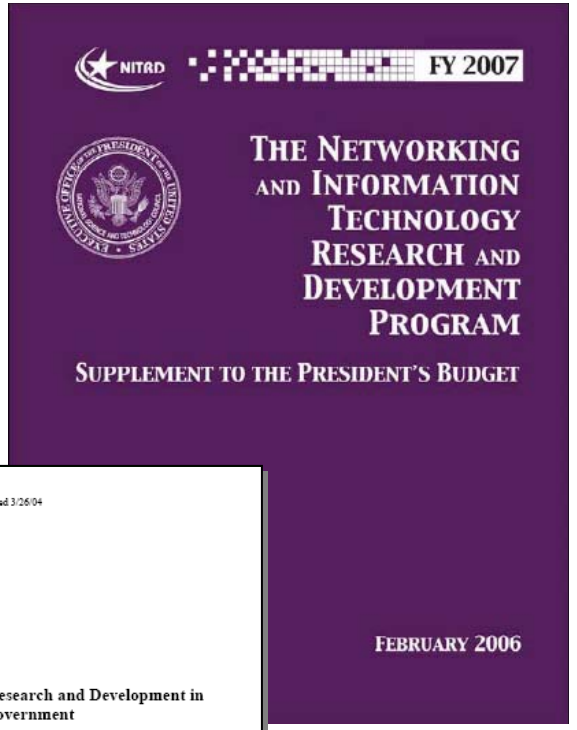
SC = subcommittee
IWG = Interagency Working Group
TG = Task Group

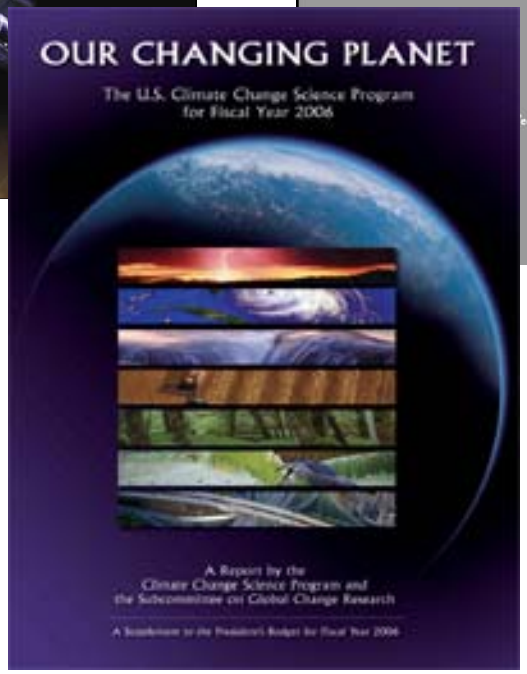
March 2006

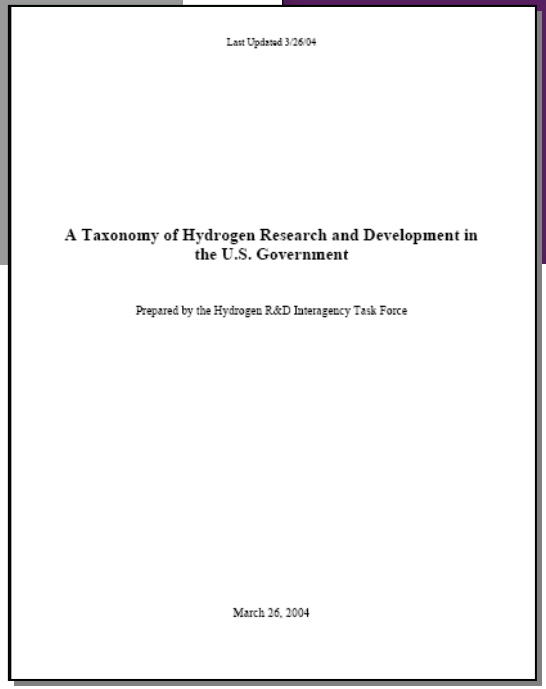
Administration Guidelines











FY07 Administration R&D Budget Priorities

http://www.ostp.gov/html/budget/2007/ostp_omb_guidancememo_FY07.pdf

- Homeland Security
  - *CBRN decontamination*
  - *Assessing spread of infectious diseases*
  - *Enhanced biometric systems*
  - *Secure land and maritime borders*
  - *Enhanced security systems through automation*
  - *Social and cultural dynamics of regional population groups*
  - *Safety of the food supply and agricultural systems*
  - *Social and behavioral research*
  - *Remote detection of nuclear material and/or devices*
  - *Remote detection/disabling of explosive devices*
- High-End Computing and Networking
- National Nanotechnology Initiative
- Priorities in the Physical Sciences
- Understanding Complex Biological Systems
- Energy and the Environment

Level of Detail Specified

DOC Guidelines

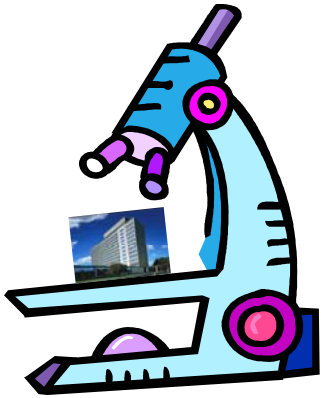
- **Competitiveness and innovation**: drive the American Competitiveness Initiative; make it impactful, meaningful and enduring.
- **China:** make China a responsible stakeholder of the worldwide community.
- **Gulf Coast Recovery:** make a real contribution to rebuilding private sector in New Orleans and other hurricane-affected areas
- **Environmental Stewardship:** promote market-driven, scientifically sound environment stewardship

Congressional and Other Guidelines

Examples:

- National Earthquake Hazards Reduction Program
- Help America Vote Act
- World Trade Center Investigation
- Health IT
- Federal Information Security Management Act
- …

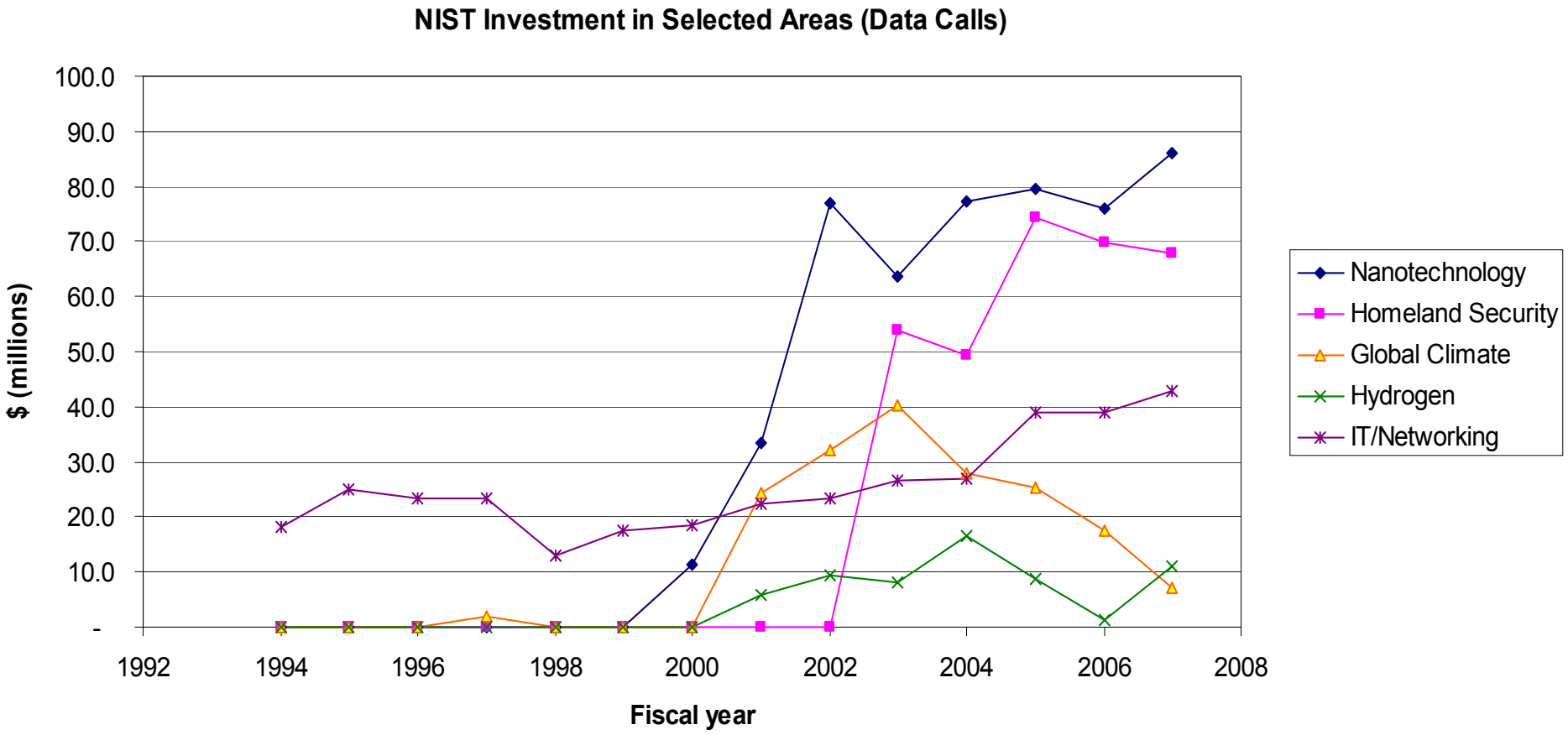
Assessments and Reviews



- *External to NIST*
  - National Research Council Reviews – Technical quality & relevance
  - Congressional Reviews and Hearings – Topical and budgetary
  - OMB Data Calls (annual) – Topical priorities
  - DOC Reviews (quarterly and annual) – Management, priorities, alignment
  - Multiple Advisory Committees – Programmatic and/or technical
  - …

- *Internal to NIST*
  - Annual Operating Unit Plans (previously)
  - Operating Unit Objective Prioritization Process (being formalized this year)
  - Operating Unit Annual Program Reviews w/Director
  - Senior Management Board Innovations in Measurement Science (Competence) Reviews
  - Senior Management Board Prioritization and “Red Teaming” of Initiatives
  - Restructured Program Office (in development)

Example: Tracking of Interagency Priorities



Note: Values of “0” typically represent years with no compilation of data – not necessarily zero investment.

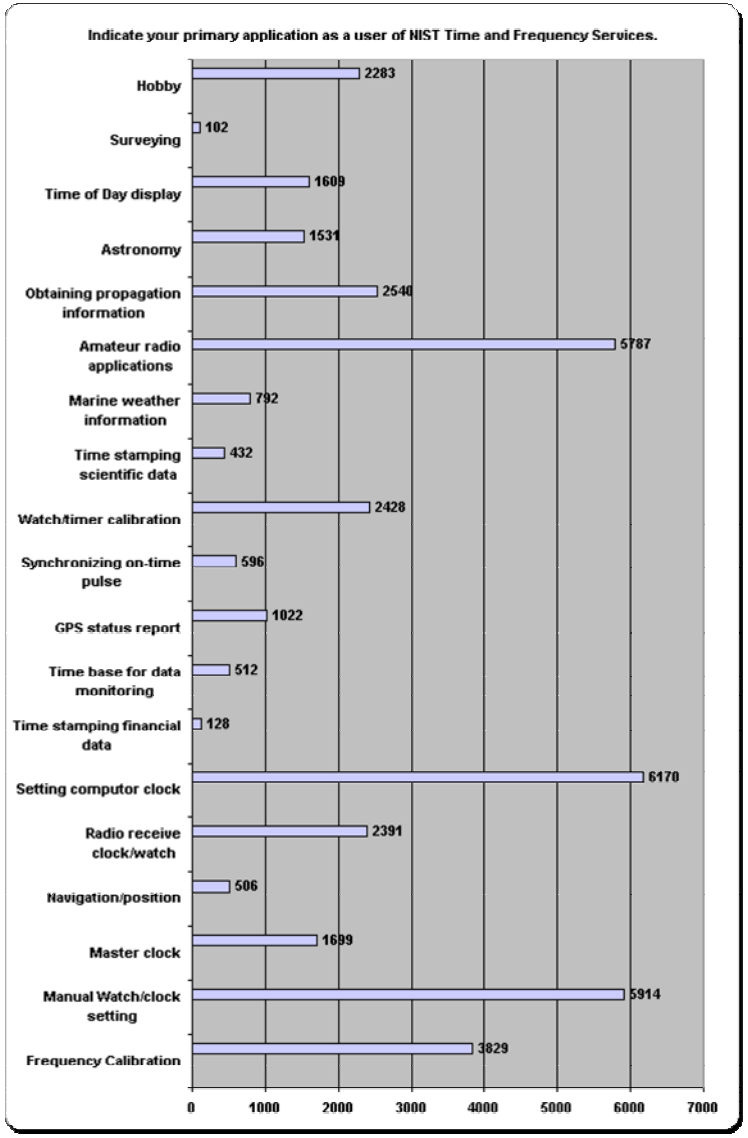
Example: Tracking of DOC Priorities

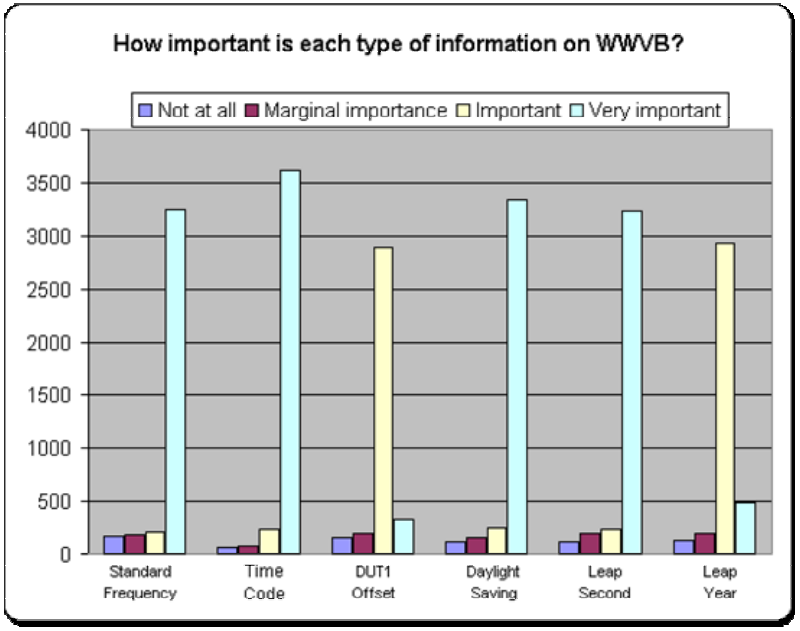
Outcomes	Sample Metrics
• R&D budget alignment with priorities	• 9% in “high risk” areas • 100% of FY07 initiatives directly traceable to Administration priorities
• Ensure R&D is impactful	• 1 prospective, 1 retrospective economic impact study in FY06 – Work statements completed for biotechnology and semiconductor
• Identify technical measurement barriers to innovation	• Collaborate with industry on 5 roadmaps in FY06: US Measurement System; Semiconductors; Electronics Manufacturing, Smart Machining, Next Gen Manufacturing
• Diffuse technical knowledge developed to the private sector	• 50 research projects with industry in FY06: > 40 CRADAs • 850 external users, 1600 guest researchers in FY06: 700 external; 1100 guest researchers • 8000 technical workshop participants in FY06: 5600

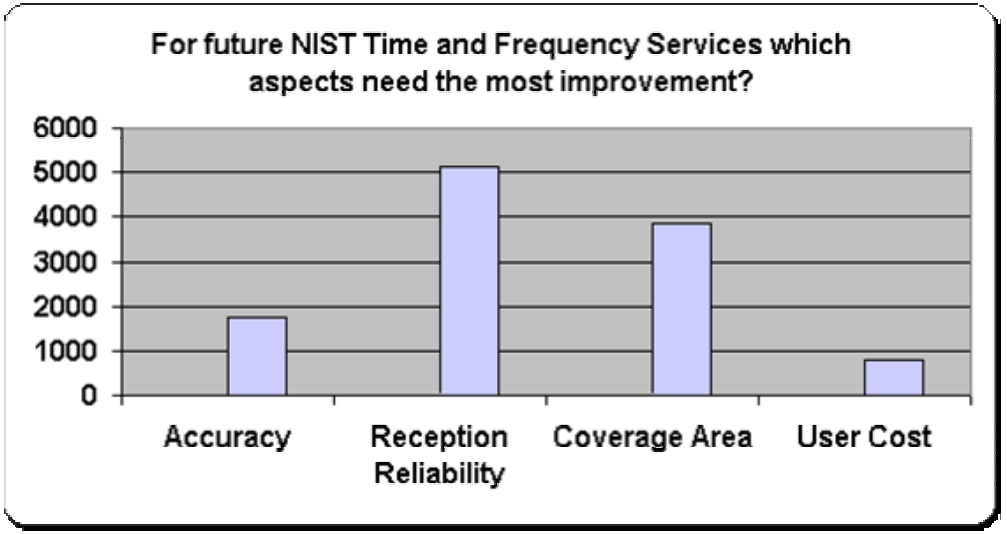
Example: President's Management Agenda

Initiative	Status & Progress	Comments
Strategic Management of Human Capital	Status:  Progress: 	NIST's Human Resources Management Division ranked in the top four of 13 HR offices in DOC in a recent DOC HR customer service survey.
Competitive Sourcing	Status:  Progress: 	NIST began a feasibility study of its OCIO desktop support; on track for all DOC requirements.
Improved Financial Performance	Status:  Progress: 	NIST has taken all necessary steps to correct construction work-in-progress deficiencies. Progress rating remains yellow until completion of FY 2006 audit; action plan milestones being met and relevant policies implemented.
Expanded Electronic Government	Status:  Progress: 	NIST supports DOC efforts to improve quality of certification and accreditation (C&A) packages for national and mission critical systems. NIST will submit two C&A packages for OIG review to help eliminate DOC's material weakness in IT security.
Budget & Performance Integration	Status:  Progress: 	NIST is on track for all budget and performance integration requirements.
R&D Investment Criteria	Status:  Progress: 	NIST completed the work plans and defined the scope for two new economic impact studies for biotechnology and semiconductors.

Example: Customer Surveys







Example: Evaluating NIST Impact

Sample of Retrospective Economic Impact Studies: Outputs and Outcomes of NIST Laboratory Research			
Industry/Project	**Output**	**Outcomes**	**Measure**
Chemicals: Standards for sulfur in fossil fuels (2000)	• Measurement methods • Reference materials	• Increase R&D Efficiency • Increase productivity • Reduce transaction costs	IRR: 1,056% BCR: 113 NPV: $409M
Semiconductors: Josephson volt standard (2001)	• Measurement methods • Reference materials	• Increase R&D efficiency • Enable new markets	IRR: 877% BCR: 5 NPV: $42M
Communications: Data encryption standard (2001)	• Standard (DES) • Conformance test methods	• Accelerate new markets • Increase R&D efficiency	IRR: 270% BCR: 58–145 NPV: $345M–$1.2B
Communications: Role-based access control (2001)	• Generic technology • Reference models	• Enable new markets • Increase R&D efficiency	IRR: 29–44% BCR: 43–99 NPV: $59–138M
Energy: Gas mixture standard for regulatory compliance (2002)	• Standard (NTRM)	• Increase productivity • Reduce transaction costs	IRR: 221–228% BCR: 21–27 NPV: $49–63M
Manufacturing: Product design data standard (2002)	• Standard (STEP) • Conformance test methods/facilities	• Increase R&D efficiency • Reduce transaction costs	IRR: 32% BCR: 8 NPV: $180M

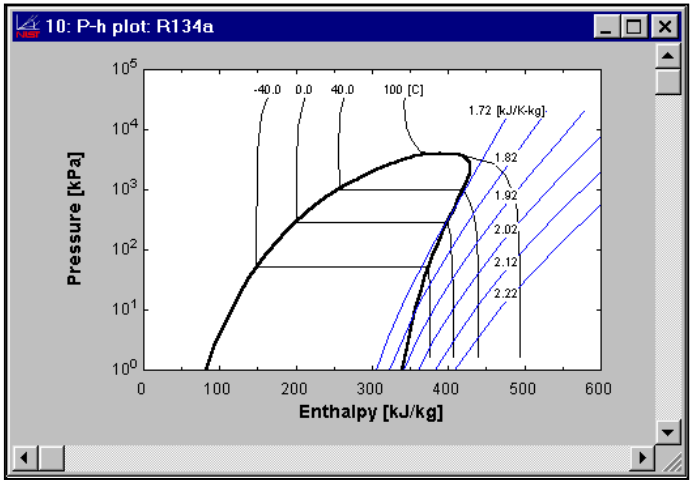
IRR=Internal (Social) Rate of Return, BCR=Benefit-Cost Ratio and NPV=Net Present Value.

Studies available at http://www.nist.gov/public_affairs/budget.htm

Example: Evaluating NIST Impact

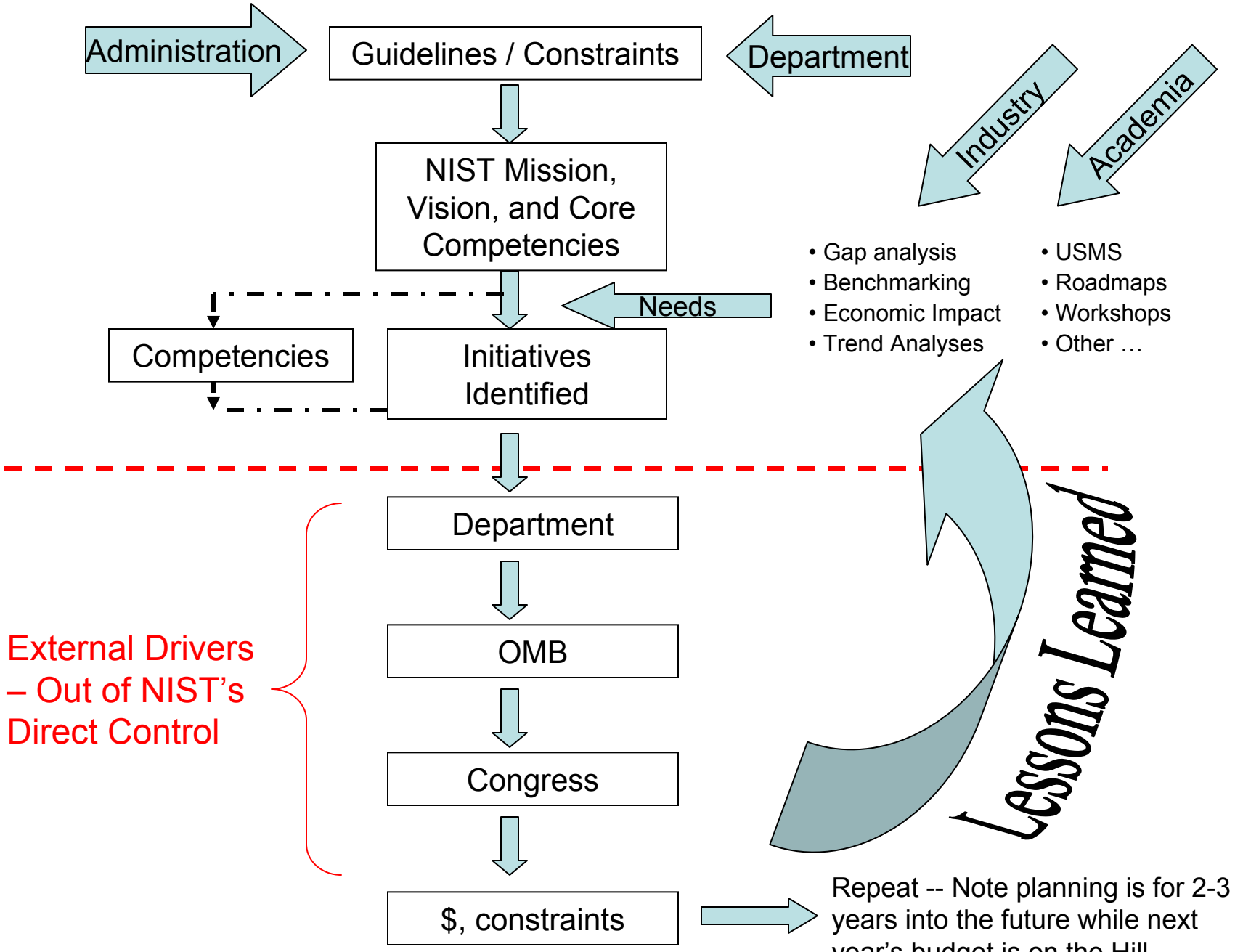
1997: Radiopharmaceutical standards
97:1 benefit-to-cost ratio

1998:
Alternative refrigerants
4:1 benefit-to-cost ratio



2000: Sulfur in fossil fuels
113:1 benefit-to-cost ratio

Average benefit-to-cost over 19 impact studies: 44:1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External Drivers – Out of NIST's Direct Control
Lessons Learned
Repeat -- Note planning is for 2-3 years into the future while next year's budget is on the Hill

Who We Are – Where We are Headed

- *Mission Statement* – revised Fall 2005 by SMB with input from VCAT
- *Vision* – draft being revised by SMB and senior OU leaders; to be sent to all staff via OUs for discussion, comments, & modifications
- *Core Competencies* – being developed by SMB for NIST-wide competencies and within each OU for unique competencies
- *Core Values* – revised by People Council Spring 2006 and approved by SMB; specific measures being assessed

NIST Mission

To promote U.S. **innovation** and industrial **competitiveness** by advancing

What

measurement science,
standards, and
technology

How

in ways that enhance *economic security* and improve our *quality of life*

Why

Vision and Core Competencies

Vision: *NIST will be the world's leader in creating critical measurement solutions and promoting equitable standards. Our efforts stimulate innovation, foster industrial competitiveness, and improve the quality of life.*

NIST-wide Core Competencies:

- *Measurement science*
- *Rigorous traceability*
- *Development and use of standards*

Each OU has its own core competencies that are more specific versions of the NIST-wide core competencies or are special statutory obligations (e.g., building failure investigations)

NIST's Core Values

People: *We value and support an inclusive, engaged, and diverse workforce capable of fulfilling the NIST mission.*

Integrity: *We are objective, ethical, and honest.*

Customer focus: *We anticipate the needs of our customers and are committed to meeting or exceeding their expectations.*

Excellence: *We expect world-class performance and continuous improvement in all we do.*

Gaps

- SWOT analysis recently completed for nanotechnology
- NIST subject matter experts assessed gaps & developed roadmaps for nanotechnology, quantum, global climate change, building security
- Each OU individually examining gaps with core competencies
- Facilities Improvement Plan being updated
- USMS identified measurement needs (gaps)
- Prospective economic studies

Example: NIST Nano “Gaps”

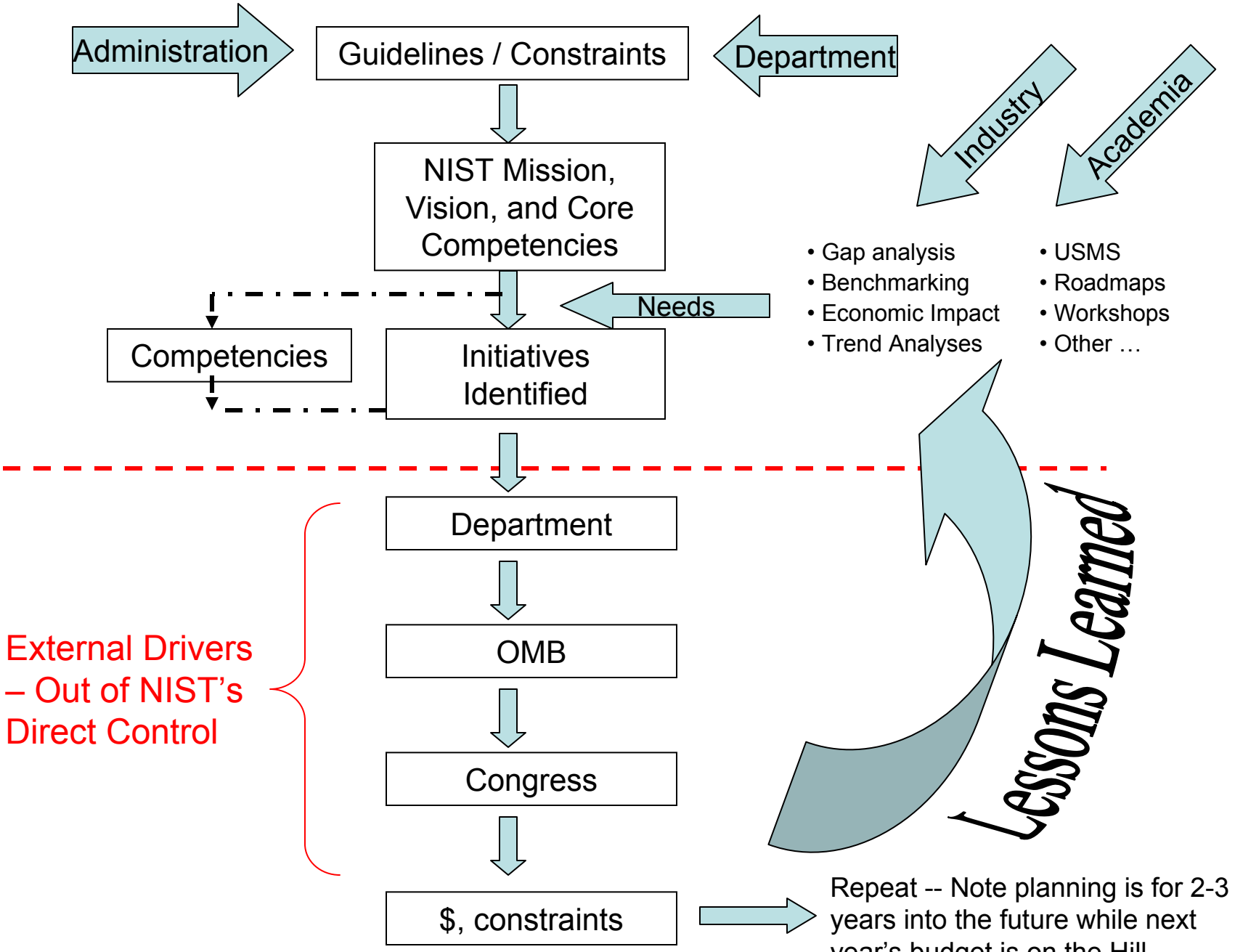
Theme	Stage I	Stage II	Stage III	Stage IV
Manufacturing	Nanomanufacturing reliability and standards	Mechanical properties of nanostructures	3D Fabrication & assembly of nanostructures	Nanomanufacturing of Post-CMOS electronics
Characterization	Advanced 2D structural imaging and characterization	3D Imaging and characterization	Atomic scale measurement & characterization	Bottom-up Assembly of nanostructures
Devices	Nanomagnetics	Simulation & modeling of nanostructures	Measurements and standards in support of nanophotonics	Standards for nanobiological and nanomedical devices
Electronics	Advanced lithography nanofabrication and soft lithography	Measurements and standards in support of ultimate CMOS	Measurements and standards in support of post-CMOS Electronics I	Measurements and standards in support of post-CMOS Electronics II

Example: US Measurement System

- 164 industry technology roadmaps reviewed
- Inputs solicited from > 120 industry, trade, standards, and professional organizations
  - 322 case study measurement needs
  - Divided into 15 Sector or Technology Areas
- 708 specific unmet industry measurement needs identified that pose technical barriers to technological innovation
- Set of validated findings based upon inferential analysis of data

Strategies & Implementation

- Help the US to drive and take advantage of the increased pace of technological change
  - U.S. Measurement System – ID measurement barriers to technological innovation
  - Center for Nanoscale Science & Technology – Bridge the gap from nanodiscovery to product
  - Ensure core competencies are adequately resourced
  - Maximize the opportunities for industry & academia to utilize unique national assets (NCNR and NSLS)
  - Ensure NIST's physical infrastructure supports future research needs
  - Establish strategic outreach & partnership with industry and academia
- Foster more efficient transactions in the domestic and global marketplace by promoting more effective development and use of standards among manufacturers and the service sector
  - Establish a strategic approach for NIST's and the country's involvement in international standards
  - Reduce inefficiencies in the supply chain through enabling interoperability in digital data flow
- Address selected critical national needs assigned to NIST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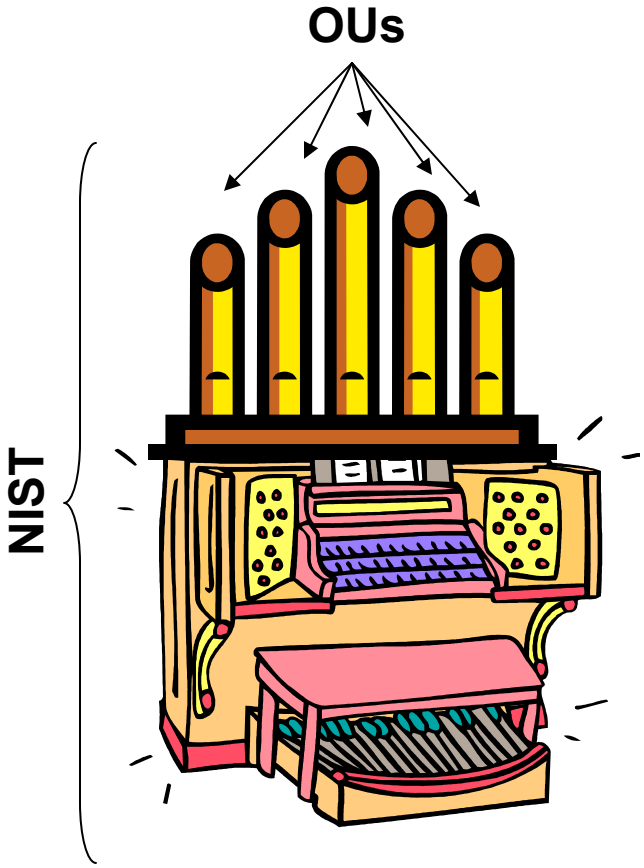
Program Priorities



- New initiatives (broad areas – nano, quantum, etc) developed at the Senior Management Level
- A typical initiative is made up of multiple programs
- Programs are managed and executed at the OU level
- Program priorities are set within an OU's objective planning process and consistent with their funding*

*Note: Appropriations done at the "lab level" and reprogramming across labs requires Congressional approval. Changing submitted budgets needs to be done ~2 years in advance.

OU Approach & Process -- EEEL

Lessons Learned and Process Improvement

- Changes to process
  - Heilmeier criteria encourage drivers and deliverables to be clearly and simply stated
  - Direct ties to national priorities and NIST core competencies help to justify initiatives to stakeholders
  - More open competition for Initiatives and Innovation Projects generate more ideas and interactions within and outside NIST
- Evaluation (Program Office)

Process for Innovation in Measurement Science Program

- Annual Competition for NIST Director's Funds
  - Each project is typically 5 years
  - Initiate several projects a year
    - ($400K to $1M/project-year)
  - High risk, high impact, technically challenging projects
- Open competition
  - Heilmeier criteria
- 34 proposals submitted for FY07
- NIST technical peer review (6 panels for the 34 proposals)
- OU Directors select finalists (10)
- Oral presentation by finalists
- Award selection by the NIST Director

NIST Process for Budget Initiatives

- Annual competition driven by guidelines/constraints & “bottoms up” ideas
  - Now starting FY09 cycle
- Open submission of proposals
  - Up to four per OU
  - Heilmeier criteria
  - Championed by single or multiple OU Directors (ensure technical quality)
- Review criteria via Red Teaming
  - OU Directors and Director’s Office
  - Tie into constraints and/or guidelines
- Director selection of possible initiatives
- Further evaluation, review with Prog. Office
- Director selects initiatives for submission to the Federal Process

Changes: Office of Planning, Analysis and Evaluation

- Expand economic analysis
- Assign analysts to work with each OU to develop and analyze strategic picture of NIST
  - 1 economist
  - 1 policist
  - 1 technologist
- Integrate budget into planning
- Integrate input from USMS and other planning activities
- Coordinate IWGs and other strategic outreach activities to develop system for responding to and influencing national priorities

Prospective Economic Analysis

The Cost of Not Having Critical Infratechnologies

Focus of Study	Infrastructure Studied	Industries Covered	Estimated Annual Costs of Inadequate Infrastructure
Interoperability costs (1999)	• Product design data exchange	• Automotive supply chain	$1 billion
Deregulation (2000)	• Metering • Systems monitoring/control	• Electric utilities	$3.1–$6.5 billion
Software testing (2002)	• All stages of the testing cycle	• Transportation equipment • Financial services • Extrapolation to entire U.S.	$1.8 billion $3.3 billion $60 billion
Interoperability costs (2004)	• Business data exchange: production scheduling, inventory management, procurement, and distribution/marketing	• Automotive supply chain • Electronics supply chain	$5 billon $3.9 billion
Interoperability costs (2004)	• Business data exchange: design & engineering, construction, and operations & maintenance	• Construction/building systems management	$15.8 billion
Medical testing (2004)	• Quality of measurement assurance	• Laboratories (calcium)	$0.06–$0.199 billion

Current PO vs. Planning, Analysis & Evaluation (PA&E)

- Existing PO
  - Permanent
    - Economist
    - Performance Specialist
    - Secretary
    - Tech support
    - VCAT exec (moved)
  - Rotators
    - 5 Program Analysts
    - Sr. Analyst
  - Director
- Total ~12

- Proposed PA&E
  - Permanent
    - 6 economists/policists
    - Secretary
    - Tech Support/Info Manager
  - Rotators
    - 4 technical analysts (incl. Sr. analyst)
  - Director and Deputy
- Total ~14

Committee on Science
SHERWOOD BOEHLERT, CHAIRMAN
Bart Gordon, Tennessee, Ranking Democrat

Press Contacts:
Joe Pouliot
(202) 225-4275

MANAGEMENT STYLE IS KEY TO NIST'S SUCCESS, SAY NIST NOBEL LAUREATES

WASHINGTON, May 24, 2006 – An open management style that encourages high-risk research is a key reason that the National Institute of Standards and Technology (NIST) has seen three of its scientists win the Nobel Prize in Physics in the past ten years, said the Agency's three Nobel laureates in Congressional testimony today.

The witnesses, who testified before the Subcommittee on Environment, Technology, and Standards, said that NIST management allowed and encouraged them to pursue innovative, high-risk research that led to important scientific breakthroughs in time measurement and to them each being awarded the Nobel Prize. The witnesses were: 1997 Nobel Prize winner Dr. William D. Philips, a scientist in the physics division at the NIST laboratory in Gaithersburg, Maryland; 2001 Nobel Prize winner Dr. Eric Cornell, a senior scientist at the NIST laboratory in Boulder, Colorado, and a fellow at JILA, the joint institute between NIST and the University of Colorado; and 2005 Nobel Prize winner Dr. John (Jan) Hall, a scientist emeritus at the NIST laboratory in Boulder, Colorado and a fellow at JILA.

"NIST has become the world leader in standards by employing superb scientists who do excellent work; nothing more clearly demonstrates the phenomenal quality of the Agency's work than the three Nobel laureates NIST has produced in less than ten years, a truly remarkable accomplishment," said **Subcommittee Chairman Vernon J. Ehlers** (R-MI). Chairman Ehlers, himself a physicist, once worked with Dr. Hall at JILA.

"What NIST – and its predecessor NBS – have done well is to establish a climate of excellence and intellectual openness wherein the research staff are proud to be members, and to recruit the most talented young scientists as they become available from time to time," said Dr. Hall.

Dr. Phillips added, "NIST encourages its scientists think 'outside the box,' to take a long and broad view of our mission, and to pursue targets of scientific opportunity at the same time that we are attending to the problems at hand. My dabblings in basic atomic physics were not just tolerated – they were encouraged and supported."

Dr. Cornell agreed, saying "Management at NIST encouraged me to pursue a high-risk research program at the cutting edge of modern physics."

Committee on Science
DEMOCRATIC CAUCUS
U.S. HOUSE OF REPRESENTATIVES REP. BART GORDON, RANKING MEMBER

Press Releases :: *May 24, 2006*

NIST Researchers Set Standard for Scientific Excellence

The House Committee on Science's Subcommittee on Environment, Technology & Standards today recognized Federal researchers who are setting the standard for scientific excellence.

"The researchers before us today are outstanding in their fields," said Subcommittee Ranking Member **Rep. David Wu** (D-OR). "In fact, it is my experience that all the researchers at NIST are first-rate. NIST's work in metrology and standards has put it at the forefront of many fields of scientific research."

Three Nobel Prize-winning researchers from the National Institutes of Standards and Technology (NIST) lent their expertise to the House panel on the state of U.S. scientific research.

With a research budget of less than $400 million per year - small compared to other Federal research agencies - NIST researchers have been awarded three Nobel Prizes during the past 9 years. No other Federal agency has such an impressive record.