

NIST ... Enabling the Future

**...Innovation, Trade, Safety and Security
... and Jobs**

Hratch Semerjian
Acting Director, NIST

Engineering R&D Symposium

April 6, 2005

**National Institute of
Standards and Technology**

NIST

NIST enables the future...

by strengthening the innovation infrastructure to:

- advance manufacturing and services
- facilitate trade
- enhance public safety & security
- improve quality of life
...and create jobs

... through effective partnerships with industry, academia, and other government agencies.



Innovation In The News ...

“Innovation will be the single most important factor in determining America’s success through the 21st century.”

Report of the “National Innovation Initiative”,
Council on Competitiveness

December 2004

“We conclude that although the United States still leads the world in research and discovery, our advantage is eroding rapidly as other countries commit significant resources to enhance their own innovative capabilities.”

Task Force on the Future of American Innovation

February, 2005

... Innovation In The News

“The balance of innovation has begun to tilt eastward, as China and India start taking their own products to market. For the first time, other nations are about to produce more U.S. patents per year than the United States.”

Craig R. Barrett, CEO of Intel
USA Today, Feb. 24, 2005

**“INNOVATION IS A GLOBAL PHENOMENON
AND THE FUTURE IS UP FOR GRABS ...**

Our nation’s technological and economic leadership cannot be taken for granted.”

TechNet Innovation Initiative
March 2005

Bottom line: *“Innovate or abdicate”*

“... we live in a competitive world ... We shouldn't take our preeminence as the world's greatest economy for granted. We've constantly got to make sure the economic environment here is strong. We've got to make sure that we're innovative.”

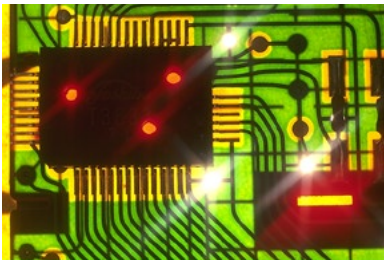
President G.W. Bush (April 5, 2004)

A National Innovation Policy

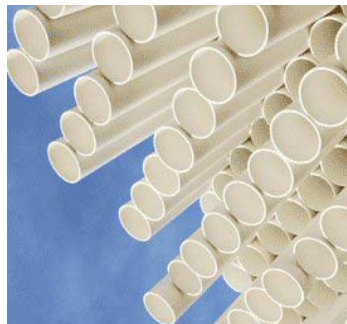
- Supporting Innovation through R&D
- Manufacturing
- Stimulating Private Investment in R&D
- Protecting Intellectual Property
- Measurements and Standards

NIST strengthens the innovation infrastructure to...

...advance manufacturing and services



semiconductor
electronics



"lean manufacturing" of
plastics



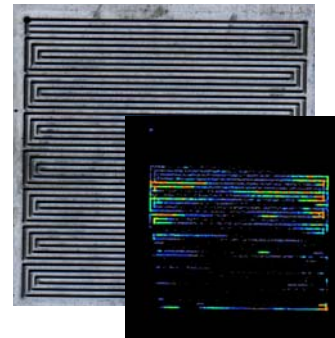
automobile
manufacturing
interoperability



pharmaceuticals



chemicals



fuel cell
technology



healthcare

NIST strengthens the innovation infrastructure to...

...facilitate trade



secure automated banking



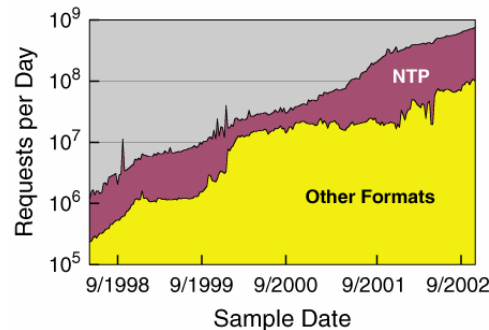
volume and flow standards



electric power metering

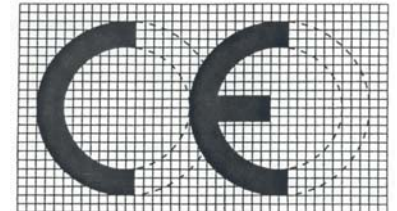


international standards to counteract TBTs



www.time.gov

billions of hits daily



EU directive on in vitro diagnostic standards

NIST strengthens the innovation infrastructure to...

...improve public safety and security



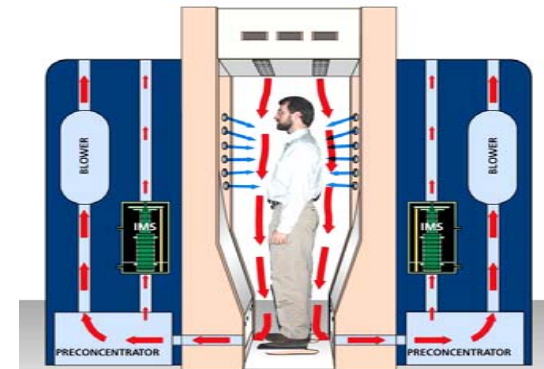
metal detectors



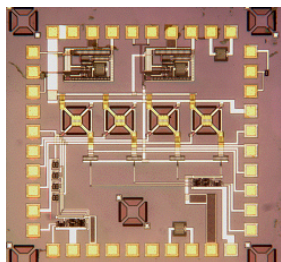
wireless interoperability among first responders



smoke detectors



Trace explosives detection



novel sensors to detect gases



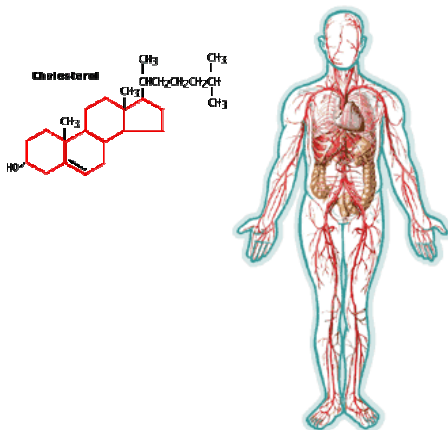
altimeter calibration



standards for body armor

NIST strengthens the innovation infrastructure to...

... improve quality of life

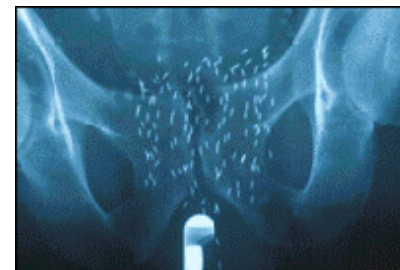
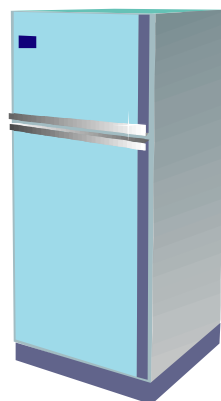


Improved clinical measurements

database and measurements for alternative refrigerants



drinking water quality



prostate and breast-cancer treatment



standards for sulfur in fossil fuels

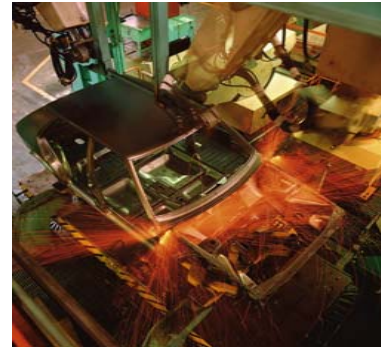
NIST serves a broad customer base...



Environmental
Technologies



Manufacturing



Transportation



Pharmaceuticals



Food and
nutrition



Law
enforcement



Biotechnology



Computer software
and equipment

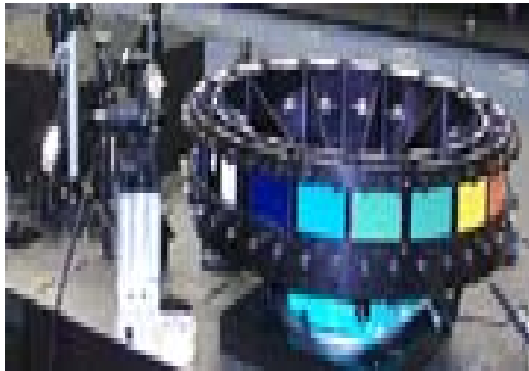


Construction



Microelectronics

...with many services and products



Calibration Services



Assistance for small manufacturers



Standard reference materials and data



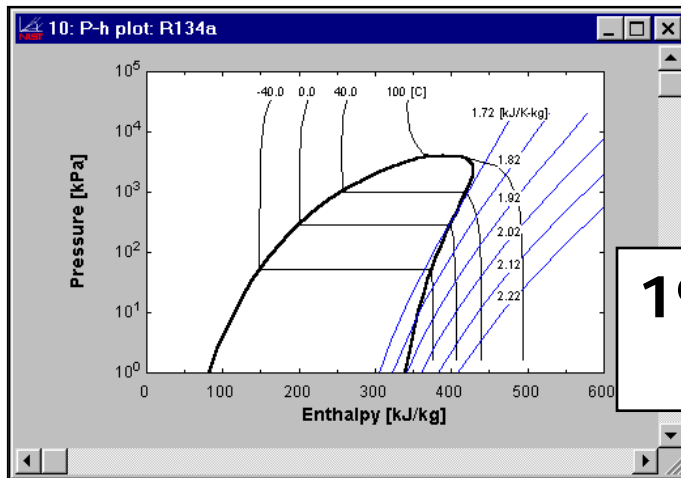
Cybersecurity Best Practices



Quality Guidelines

Economic impact of NIST programs

**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**



Economic impact of NIST programs (cont'd)

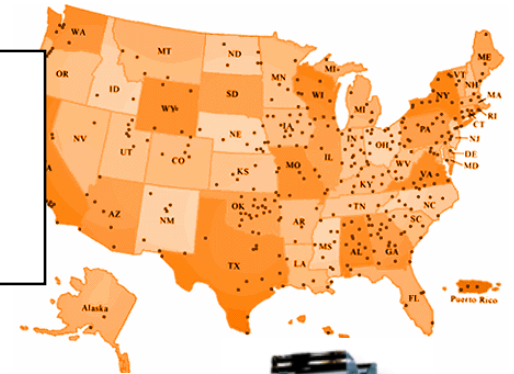
Since inception



Returns from just 6 % of ATP portfolio:

- \$17 billion in economic benefits
- 8 times total ATP investment

2003 Manufacturing Extension Partnership
\$4.1 billion new & retained sales
50,315 jobs created & retained



Since 1988 Baldrige National Quality Program
\$25 billion in economic benefits
207:1 benefit-to-cost ratio



NIST has...

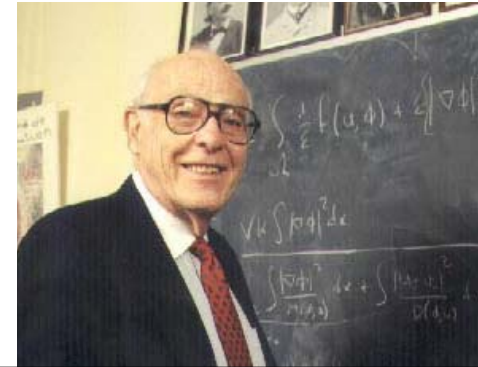
...world-class staff



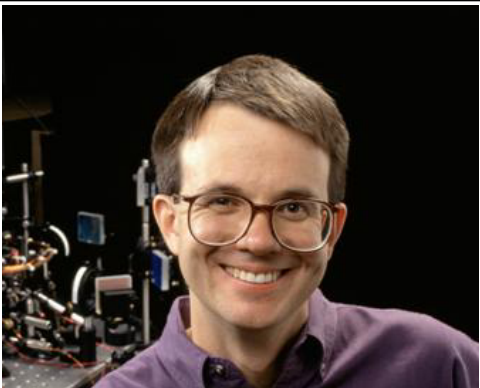
Bill Phillips
*1997 Nobel Prize
in Physics*



Greg Linteris
2 Space Shuttle missions



John Cahn
*1998 National Medal of
Science*



Eric Cornell
*2001 Nobel Prize
in Physics*



Anneke Sengers
*2003 L'Oréal-UNESCO
Women in Science Award*



Debbie Jin
*2003 MacArthur
Fellowship*

NIST has...

...unique research facilities



**Advanced Measurement
Laboratory (2004)**

**Advanced Chemical Sciences
Laboratory (1999)**



**NIST Center for
Neutron Research**

**National Institute of
Standards and Technology**

NIST

NIST has...

...strong partnerships

Partnerships with industry, academia, and other government agencies have been an **integral part of NIST culture** since 1901.



INTERNATIONAL TECHNOLOGY ROADMAP FOR SEMICONDUCTORS



National Institute of Standards and Technology

NIST

NIST has...

...strong partnerships



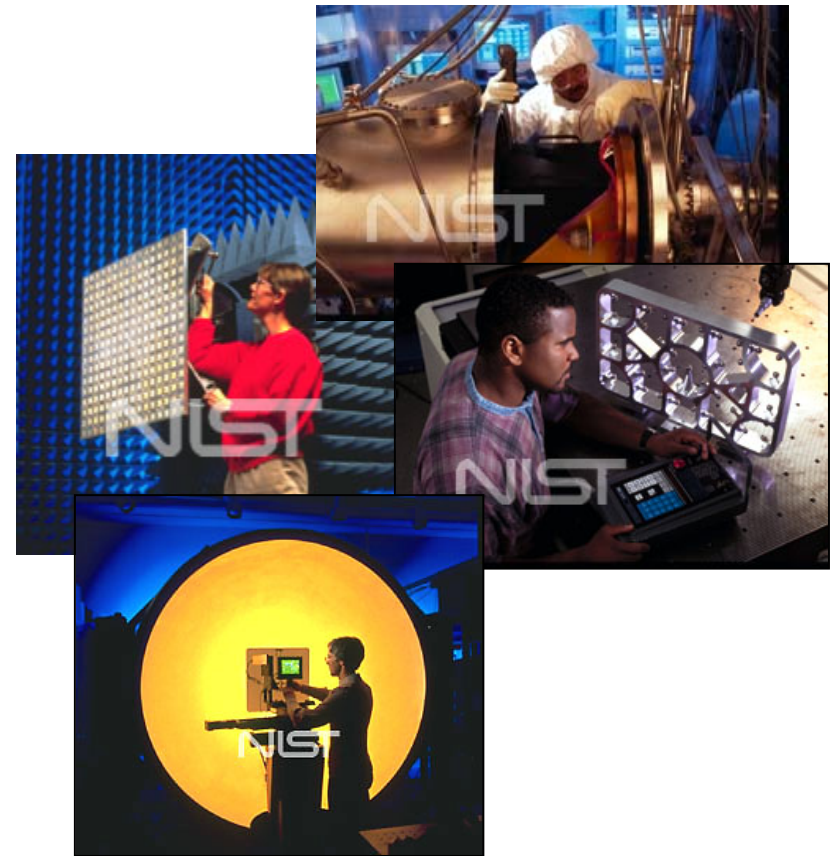
National Institute of Standards and Technology

NIST

National Institute of Standards & Technology

NIST Assets Include:

- 3,000 employees
- 1,600 associates
- \$858 million FY 2005 operating budget
- NIST Laboratories -- National measurement standards
- Advanced Technology Program
- Manufacturing Extension Partnership
- Baldrige National Quality Award



Smart But Tough Budget Choices

The President's FY 2006 budget for TA/NIST is a smart budget that includes impressive increases for research and development programs.

- NIST's Laboratories program reflects an increase of \$47.2M, or 12.7 percent over the FY 2005 appropriation.
- The proposed budget for TA reflects the same kind of difficult budgetary choices that have been made throughout the U.S. government.
- These tough choices necessitate the elimination of the Advanced Technology Program and the reduction for the Hollings Manufacturing Extension Partnership Program.

NIST FY 2006 Budget Request (\$M)

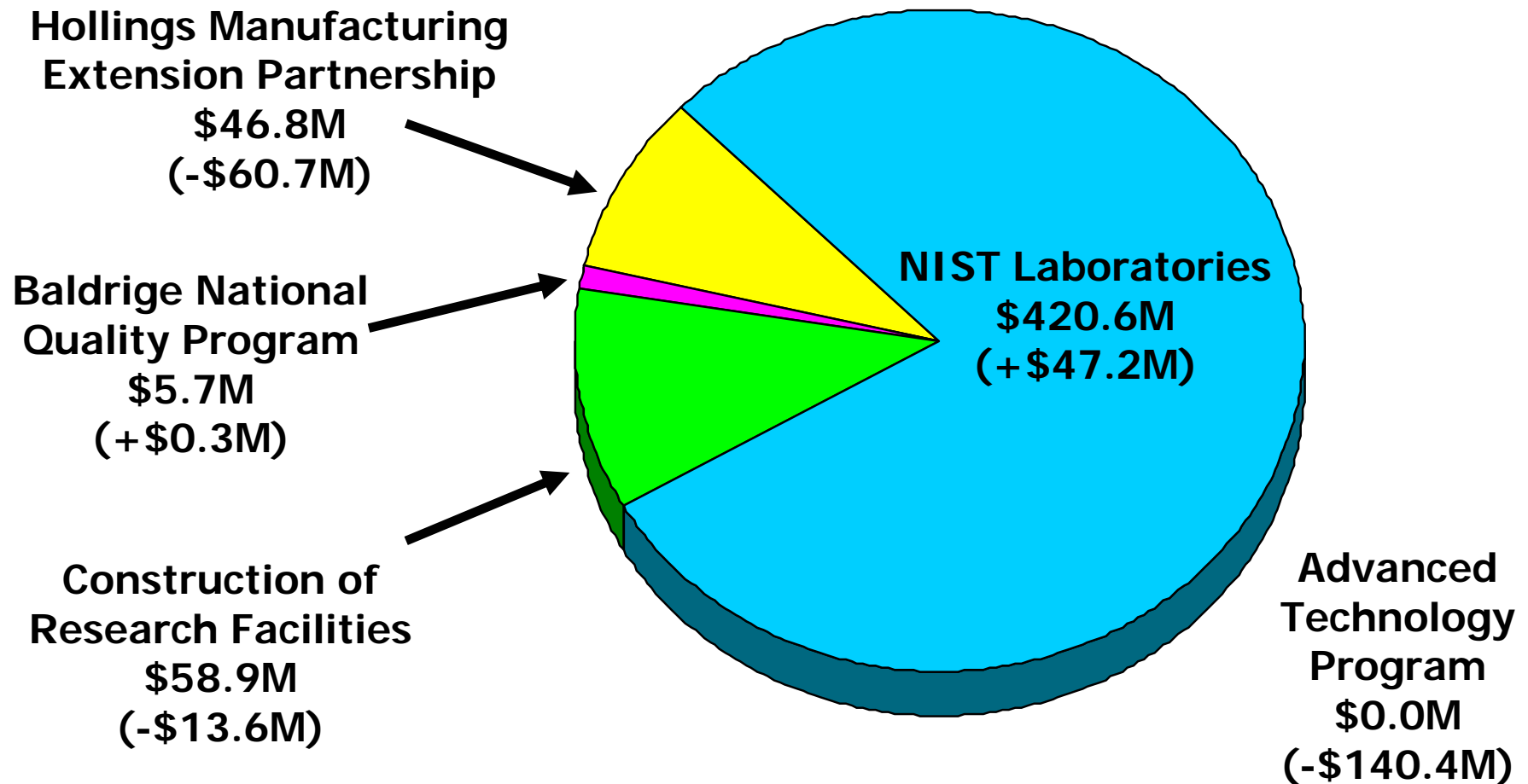
Appropriation:	FY 2004	FY 2005	FY 2006
Scientific & Technical Research & Services (STRS):	Enacted	Enacted	Request
NIST Laboratories	335.1*	373.4 *	420.6
Baldrige National Quality Program	5.6	5.4	5.7
Subtotal, STRS	340.7	378.8	426.3
Industrial Technology Services (ITS):			
Advanced Technology Program	177.3	140.4	0.0
Hollings Manufacturing Ext. Partnership	39.2	107.5	46.8
Subtotal, ITS	216.5	247.9	46.8
Construction of Research Facilities (CRF):			
Construction and Major Renovations	20.9	6.9	23.9
Modifications and Improvements	22.6	22.7	35.0
Directed Grants	20.8	42.9	0.0
Subtotal, CRF	64.3	72.5	58.9
Total	621.5	699.2	532.0

FY 2004 and FY 2005 amounts do not reflect rescissions of unobligated balances.

**Congressionally-directed STRS grants included: \$13.8M STRS in 2004; \$8.8M in 2005.*

NIST FY 2006 Budget Request to Congress (Compared to FY 2005 Enacted)

Total FY 2006 Request: \$532.0M



NIST FY 2006 Budget Increases for the NIST Laboratories

- Provide the measurement and standards infrastructure to support **Advances in Manufacturing (+\$19.6M)**
- Provide the measurement and standards infrastructure necessary to improve **Measurements and Standards for Homeland Security (+\$3.0M)**
- Explore **New Measurement Horizons for the U.S. Economy and Science** to anticipate and respond to the needs of the Nation's scientific and industrial communities in rapidly developing technology areas (**+\$17.2M**)

Advances in Manufacturing (+\$19.6M)

Advances in measurement technology are needed to support sustained, superior innovation in 21st century manufacturing.

NIST solutions:

Four strategic measurement capabilities and activities with an emphasis on cooperative research with the private sector:

- National Nanomanufacturing and Nanometrology Facility (+\$10.0M)
- Nanomanufacturing Research (+\$4M)
- Manufacturing Enterprise Integration (+\$1.6M)
- Expanding Access to Global Markets through Measurements and Standards (+\$4.0M)

Advances in Manufacturing

National Nanomanufacturing and Nanometrology Facility (+\$10.0M)

Research and partnerships to translate nanoscience innovation into manufacturing jobs and economic growth.

- Leverage the unique resource provided by the recently completed NIST Advanced Measurement Laboratory
- Develop *Instrumentation Research, Metrology, and Standards for Nanotechnology*, an overarching goal in the National Nanotechnology Initiative Strategic Plan
- Develop nanoscale measurement and fabrication technologies

Advances in Manufacturing

Nanomanufacturing Research(+\$4.0M)

- Measurements and standards will be developed in the areas of nanodevices, nanomagnetics, nanomanipulation, and nanocharacterization for the developing nanotechnology industry
- Work will utilize the world's best measurement and nanometrology research facility, the AML
- The AML measurements can be accurately made at the scale of individual atoms
- This program will leverage the AML investments and make its benefits immediately accessible to U.S. nanomanufacturing researchers through the National Nanomanufacturing and Nanometrology Facility (N3F)

Advances in Manufacturing

Manufacturing Enterprise Integration (+\$1.6M)

Open new global markets to small manufacturers by enabling them to communicate electronically with business partners.

- Excess costs to U.S. economy due to poor supply chain efficiency:
 - automotive industry: \$5.0B/yr
 - electronics industry: \$3.9B/yr
 - construction industry: \$15.8B/yr
- Work with private sector to enable development of technically sound and unbiased standards critical for e-business
- Provide level of quality required for trust and confidence in transactions

Advances in Manufacturing

Expanding Access to Global Markets through Measurements and Standards (+\$4.0M)

Retain and create U.S. manufacturing jobs by meeting the international standards challenge.

- Improve U.S. manufacturing productivity by providing efficient access to NIST measurement traceability
- Align U.S. standards for measuring instruments with international standards for seamless export
- Provide technical leadership and coordination to
 - ease access to foreign markets
 - ensure that U.S. interests are fairly represented

Measurements and Standards for Homeland Security (+\$3.0M)

Through interdisciplinary measurements and standards, NIST is helping law enforcement, the military, emergency services and others to protect America from terrorist threats.

NIST solutions:

Two public safety and security programs to ensure delivery of infrastructural support essential to meeting critical safety and homeland security goals:

- Improved standards and guidelines for first responders and buildings (+\$2.0M)
- Biometrics (+\$1.0M)

Measurements and Standards for Homeland Security

Improved standards and guidelines for first responders and buildings (+\$2.0M)

Respond to highest priority national needs.

Enable development and adoption of cost-effective technical solutions to enhance safety and avoid major disasters.

- Improved first responder equipment
- Better evacuation and emergency response procedures
- Risk-sensitive national practices for building safety

Measurements and Standards for Homeland Security

Biometrics (+\$1.0M)

Dramatically improve accuracy of biometrics for border security by developing and certifying technical performance standards.

- Develop prototypes and tests for advanced systems that simultaneously process facial, fingerprint, and iris data (multi-modal systems)
- Support the requirements of the USA PATRIOT Act by developing tests for accuracy and interoperability of technologies that work in real-time environments

New Measurement Horizons for the U.S. Economy and Science (+\$17.2M)

The Nation's scientific and industrial communities are challenged to keep pace with fast-breaking developments at the forefront of science and technology.

NIST solutions:

Advanced measurements, standards, and services to promote innovation in three rapidly developing technology areas:

- Biosystems and Health (+\$7.2M)
- Interoperability and Security for Emerging Scientific Systems (+\$2.0M)
- Quantum Processing—Beyond High-End Computing (+\$4.0M)
- Building Competence for Advanced Measurements (+\$4.0M)

New Measurement Horizons for the U.S. Economy and Science

Biosystems and Health (+\$7.2M)

**Accelerate U.S. global success in bio-innovation,
manufacturing, and trade.**

- Integrate the quantitative, physical sciences with biosystems and health arena for technology innovation
 - Bioinformatics--marriage of molecular biology with computer science
 - BioImaging--measurement science necessary to collect, analyze and store images reproducibly and securely
 - Measurement tools for gene and protein expression--enabling the discovery of new pharmaceuticals and of the causes of diseases

New Measurement Horizons for the U.S. Economy and Science

Interoperability and Security for Emerging Scientific Systems (+\$2.0M)

Build trust, confidence, and usability in future scientific systems.

- Develop fundamental standards and measurements for emerging systems such as UPC code-replacing Radio Frequency Identification (RFID) tags for product identification
- Maximize the performance and security of future components, systems, and networks

New Measurement Horizons for the U.S. Economy and Science

Quantum Processing—Beyond High-End Computing (+\$4.0M)

Develop the measurements and standards to enable quantum information science, which will likely revolutionize science and technology and produce tremendously powerful computing capabilities.

- Conduct world-leading research effort
- Develop prototype quantum processors
- Explore new approaches to computer architectures needed for quantum computing
- Develop understanding of quantum processors' memory control and of quantum languages, resulting in new information metrics and protocols

New Measurement Horizons for the U.S. Economy and Science

Building Competence for Advanced Measurements (+\$4.0M)

Provide seed funds to explore high-risk, leading-edge research concepts that anticipate entirely new future measurement and standards needs of industry.

- Expand the scope and nature of the awards toward the development of multidisciplinary research projects that have greater visionary scope and impact
- Select and initiate several innovative strategic projects per year so that the total Competence Program represents approximately 5 percent of the total NIST Laboratories' efforts

NIST FY 2006 Budget Request for Industrial Technology Services

Budget constraints have required some tough budget decisions.

- **Advanced Technology Program (- \$140.4M):**
 - No funding requested for FY 2006

- **Hollings Manufacturing Extension Partnership (- \$60.7M):**
 - Decrease reflects Administration's policy and funding priorities

NIST FY 2006 Budget Request for Construction of Research Facilities Appropriation (+\$35.4M)

The single most pressing facilities issue for NIST is the growing obsolescence due to aging.

NIST solutions:

- Facilities Improvements (+\$32.0M)
- Maintenance for the Advanced Measurement Laboratory (+\$3.4M)

Construction of Research Facilities

Facilities Improvements (+\$32.0M)

World-class work is impeded by obsolete Boulder and Gaithersburg facilities.

NIST solutions:

- Boulder Central Utility Plant (+\$9.4M)
- Boulder Building 1, Phase 1 Design (+\$6.5M)
- Boulder Building 4 Design and Limited Renovation (+\$4.0M)
- NIST North Relocation and Remediation (+\$4.0M)
- Safety, Capacity, Maintenance, and Major Repairs Base (+\$8.1M)



President Eisenhower dedicates NIST's Boulder campus in 1954