

NIST Overview

William Jeffrey
Director
March 2007



NIST

**National Institute of
Standards and Technology**

Technology Administration
U.S. Department of Commerce

Outline

- **Welcome & Update**
- NIST Expectations of VCAT
- FY06 Report / Recommendations
- FY08 Budget Request
- What is NIST?

New VCAT Members

- **Vinton Cerf**
 - VP and Chief Internet Evangelist (Google)
 - “Father of the Internet”
 - U.S. National Medal of Technology
 - Presidential Medal of Freedom
 - National Academy of Engineering
- **William Happer**
 - Physics Professor at Princeton University
 - Member of JASON
 - Director of the Office of Energy, DOE (1991-1993)
 - National Academy of Sciences
- **Elsa Reichmanis**
 - Director, Materials for Communications Research (Alcatel-Lucent)
 - Bell Labs Fellow
 - President of the American Chemical Society (2003)
 - National Academy of Engineering

Dashboard

	Status	Progress
• FY08 Budget		
• Personnel		
• Safety		
• Outreach		
• Technical Assessment		
• IG & GAO Reviews		
• President's Management Agenda		

Personnel

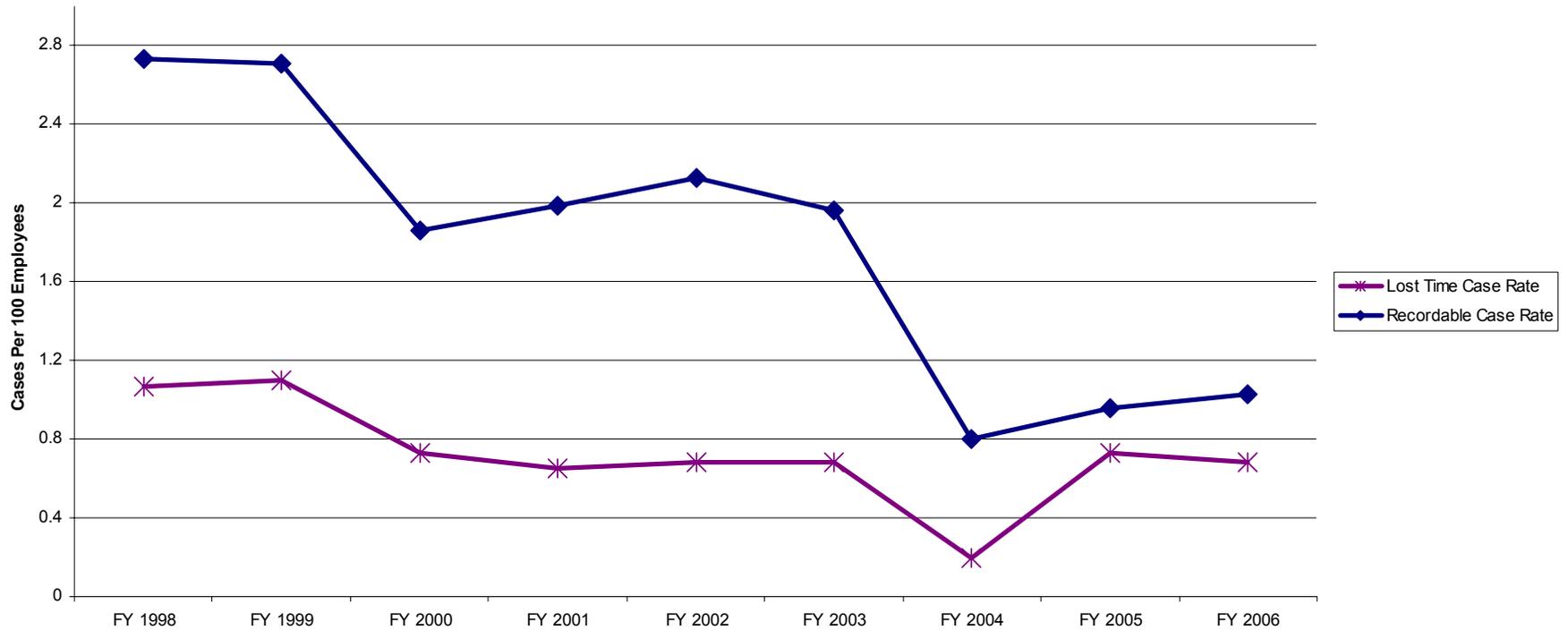
Status: ● Progress: ●

- Senior Positions Filled Since 8/1/05:
 - Chief Financial Officer
 - Chief Human Capital Officer
 - Chief Information Officer
 - Chief Scientist
 - Chief Reactor Operations (NCNR)
 - Director, Boulder Labs
 - Director, CNST
 - Director, ITL
 - Deputy Director, ITL
 - Director, MEP
 - Deputy Director, MEP
 - Director, MSEL
 - Deputy Director, MSEL
 - Director, TS
 - Deputy Director, TS



- Senior Positions Vacant:
 - Deputy Director (in process)

Incident and Illness Statistics 1998 through FY2006



Outreach

Status: ● Progress: ●

- Industry (for example):
 - CEO, Texas Instruments
 - Senior VP (Technology), Halliburton
 - President, SWRI
 - VP, BAE Systems
 - CEO, Zyvex
 - Corporate Executive Board (R&D Tech Council)
 - High Technology Councils in Boston and Hampton Roads
 - Chambers of Commerce in San Antonio and Arlington
 - Council on Competitiveness
 - ITAA, OIDA, SIA
- Academia (for example):
 - Chancellors of UT, A&M, Texas Tech
 - MIT
 - University of Maryland
 - Boston University
 - National Academies
- Government (for example):
 - OSTP, OMB, PCAST, FBI, DTO, NISTC
 - House Science Committee Staff, House and Senate Appropriations Staff



Technical Assessment

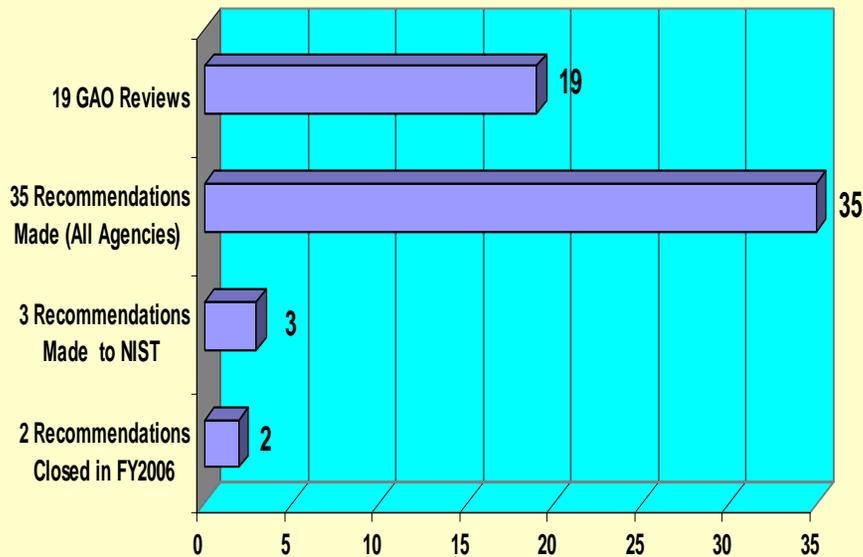
Status:  Progress: 

- Internal:
 - Operating Unit: Each OU has/is implementing an objective prioritization process (VCAT has been briefed on this over the past year)
 - Program Office: Transformation underway to create an analysis and evaluation office (VCAT has been briefed on this over the past year)
- External:
 - Contract with National Research Council (NRC) has been renegotiated and is in place

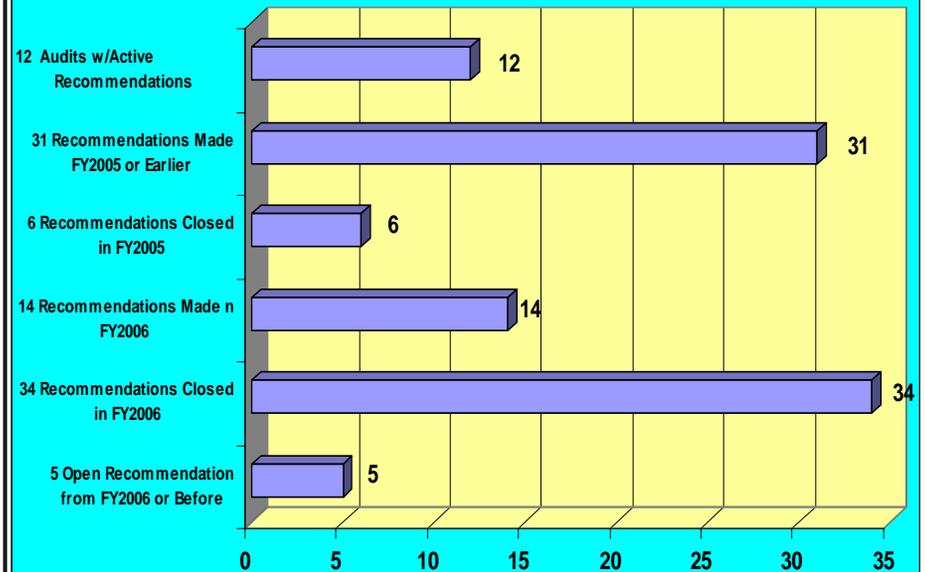
IG and GAO Reviews

Status: ● Progress: ●

GAO Review Support FY2006



OIG Audit Support FY2006





President's Management Agenda

HUMAN CAPITAL

Status Progress

- Maintaining current green ratings is contingent on NIST aligning its accountability plan with the Department's accountability plan, and documenting measurable results.
- During Q4, FY 2006, NIST held its first annual Human Resources Management Division Customer Appreciation Day, HR4U which improved client understanding of HR services.

COMPETITIVE SOURCING

Status Progress

NIST completed a feasibility study in FY 2006 and has committed to another in FY 2007.

FINANCIAL PERFORMANCE

Status Progress

NIST's progress rating was raised to green as a result of fully addressing concerns regarding Construction Work in Progress. The auditors have informed the Department that the reportable condition has been eliminated.

E-GOVERNMENT

Status Progress

NIST needs to continue emphasis on improving information technology security certification and accreditation processes and documentation, and meet negotiated dates for completion.

BUDGET & PERFORMANCE

Status Progress

NIST is working to further improve the integration of planning, performance, and evaluation information into budget documents.

R&D INVESTMENT

Status Progress

- NIST awarded NRC a contract to assess selected NIST Laboratory programs.
- NIST established the Joint Quantum Institute with the University of Maryland and NSA.
- NIST submitted its report on assessment of the U.S. Measurement System to OMB.

PART Summary

Program	Year	Score	Rating
NIST Laboratories	2003	85	Effective
Small Business Innovative Research (NOAA/NIST) ¹	2003	27	Results Not Demonstrated
Advanced Technology Program (ATP)	2002	66	Adequate
Manufacturing Extension Partnership (MEP)	2002	75	Moderately Effective

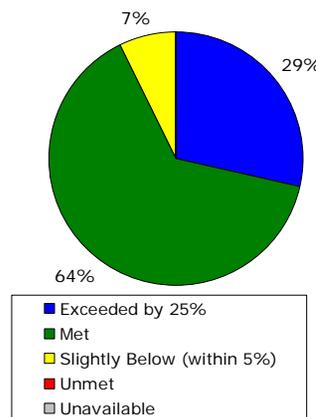
¹ OMB is developing SBIR policy; old scores in this area are not counted against bureau.

Funding Summary (\$ millions)

Total Plan	\$953.3
Estimated Spent	\$941.2
+/- Total	\$12.1
% of Total Spent	99%

NIST reports finishing the year at 99% of planned spending.

Performance Measures



•All of NIST's measures are annual in nature and the ones for ATP and MEP are for FY 2005 as they lag for one year; results for FY 2006 funding will not be available until early FY 2008.

•NIST has a quarterly status for four of its measures: peer-reviewed technical publications, standard reference materials (SRMs) sold, NIST-maintained databases downloaded, and number of items calibrated. NIST met target levels in all four of these categories; NIST exceeded the target for "Number of Baldrige Criteria Disseminated."

•NIST scientific activities completed an annual qualitative review process.

2006 Presidential Rank Awards

Recognizing exceptional long-term accomplishments in the public sector by career service government executives



Katharine Gebbie
Distinguished



Robert Celotta
Distinguished



Todd Grams
Distinguished



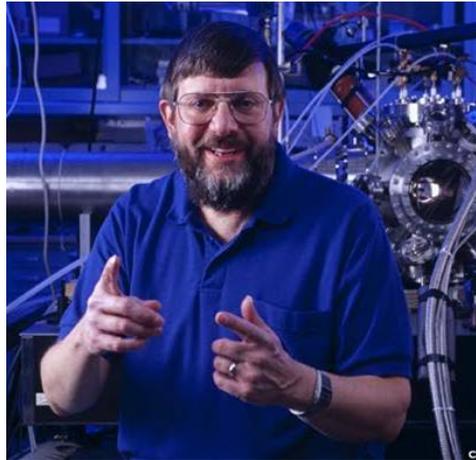
Robert Moore
Meritorious



James Faller
Meritorious

More Staff Recognition

William Phillips
*2006 Service to
America
Career Achievement
Medal*



David Wineland
*Scientific
American 50*



Jun Ye
*2007 I.I. Rabi Prize
and
2006 William F. Meggars
Award*



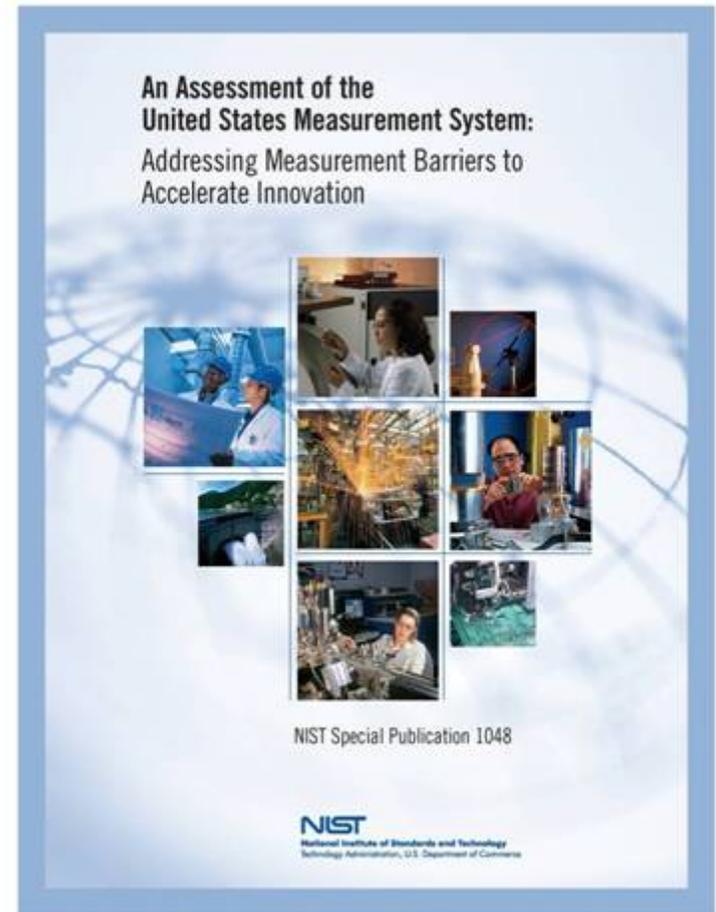
Kent Irwin
*2007 Joseph F.
Keithly Award
For Advances in
Measurement
Science*



Technical Highlights ... *Assessing Industry Needs*

An Assessment of the USMS:

- Released February 12, 2007.
- Based on an analysis of more than 700 scientific and technical measurement challenges facing U.S. industry.
- 11 industrial sectors and technology areas surveyed.
- These challenges were identified in 15 specially convened workshops, reviews of over 160 public and private sector technology “roadmaps”, and interviews.
- More than 1,000 people in industry, academia, and government involved in the study.



Technical Highlights ... *Responding to National Needs*

Two E-Voting Test Labs Accredited:

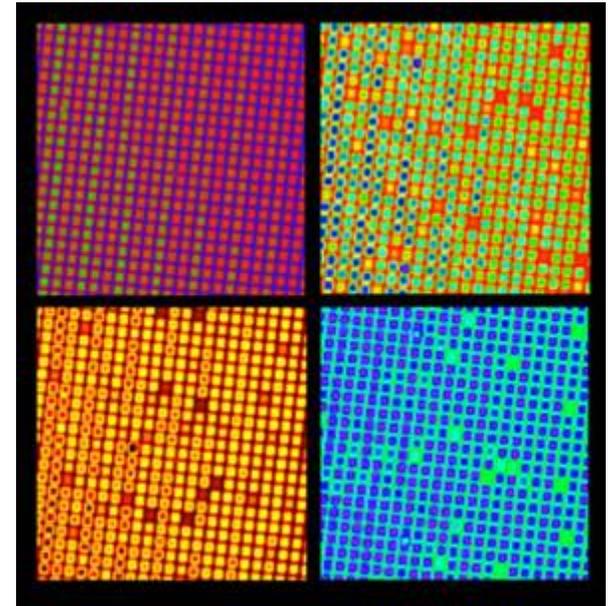
- On February 21, 2007, the U.S. Election Assistance Commission (EAC) approved the accreditation of the first two companies to test electronic voting machines.
- In response to the Help America Vote (HAVA), NIST performed a comprehensive technical evaluation of these two laboratories to test voting system hardware and software for conformance to federal standards and proposed their accreditation to the EAC.



Technical Highlights ... *Rapidly Developing Technologies*

2 D Pictures of NIST “Frequency Combs”:

- NIST scientists have developed a new method for taking the first ever two-dimensional pictures of a “frequency comb.”
- This work demonstrates a novel method for separating and identifying thousands of individual colors—or frequencies—of visible light while simultaneously measuring intensity and imaging the results in real time.
- This extra two-dimensional information enhances the comb’s usefulness in optical atomic clocks, secure high-bandwidth communications, real-time chemical analysis, remote sensing, and the ultimate in precision control of atoms and molecules.

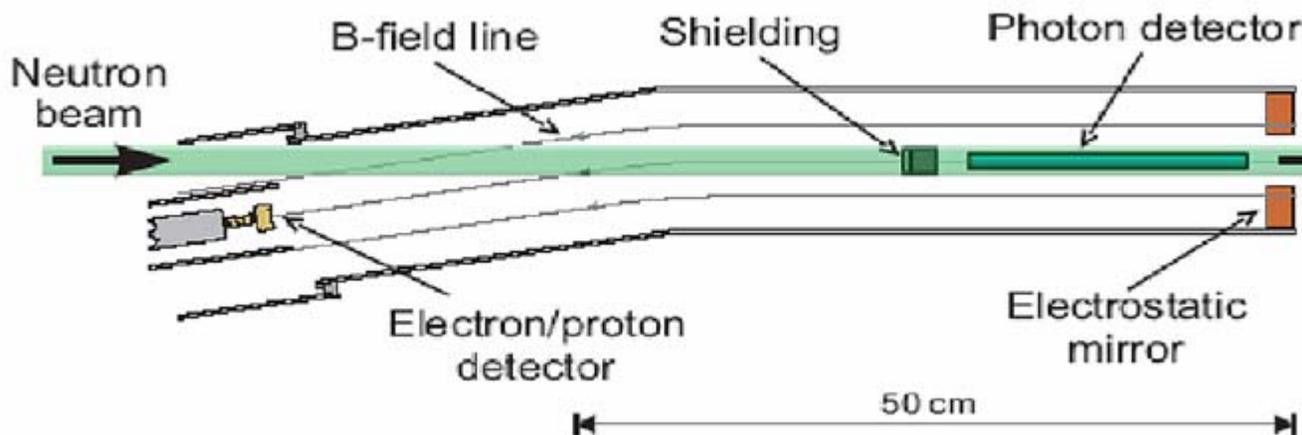


False-color images of the "fingerprints" of molecular iodine, each taken under different experimental conditions using a NIST frequency brush created with an ultrafast visible laser. The variation in the colors reveal where the iodine absorbs specific optical frequencies.

Technical Highlights ... *Critical National Assets*

Rare Glimpses of Lights from Neutrons:

- Researchers from NIST and 4 universities have made the first experimental observation of rare particles of light emitted during the radioactive decay of the neutron, a key building block of matter.
- This work confirms theoretical predictions of this type of decay of the neutron and sets the stage for a new class of tests of basic theories in particle physics.
- Experiments were performed at the NIST Center for Neutron Research



A top-view illustration of the detection scheme for measuring the radioactive decay of the neutron. The shielding and photon detector lie below the neutron.

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NIST Expectations of VCAT

“Each such report shall identify areas of research and research techniques of the Institute of potential importance to the long-term competitiveness of United States industry, in which the Institute possess special competence, which could be used to assist United States enterprises and United States industrial joint research and development ventures.”

My goals for the VCAT for FY2007:

1. Help identify areas of research important to the Nation – and consistent with NIST’s vision and core competencies
2. Emphasis on the “WHAT” and “WHY” -- **not** “HOW”
3. Maintain an open and transparent process
 - Only recommendations discussed and voted on in public should be recorded
 - Dialogue between meetings are OK (and encouraged) – but that should be to “tee up” discussions at the open meetings
4. Enjoy the meetings. This is important – but really cool!

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FY06 VCAT Recommendations (1 of 3)

- *The Committee supports the addition of a national priorities element to the NIST strategic plan.*
 - Starting with FY07 budget -- all NIST initiatives show traceability to national priorities (when appropriate.)
- *The establishment of the concept of the NIST Center for Nanoscale Science and Technology is a very important accomplishment. The committee encourages NIST to complete the concept development and to ensure funding as soon as practical.*
 - All policy documents related to CNST are near completion. Delay due to FY07 continuing resolution – but should be completed by May 2007. In terms of funding -- NIST can request funding but not “ensure funding”.
- *The Committee...encourages NIST to carefully select its fundamental work [in biosciences] based on what will be important to the future of this overall technology.*
 - NIST initiatives must go through a rigorous review which includes (in addition to technical) an assessment of its potential impact to the nation as well as ensuring that the work is consistent with NIST’s vision and core competencies. Significant private sector input is considered (e.g., USMS, workshops, consortia, etc.). In addition, we are encouraged by the VCAT forming a subcommittee to consider biosciences.
- *The VCAT encourages NIST to continue to address the need for the US Measurement System (USMS) effort.*
 - NIST is institutionalizing USMS. TS will manage the USMS to work with stakeholders and updates. Each OU will consider the USMS in its internal prioritization and in new initiatives.

FY06 VCAT Recommendations (2 of 3)

- *The Committee suggests that actions be taken where needed to strengthen the [strategic planning] analysis and the benchmarking aspects.*
 - At the OU level, developing and implementing a rigorous and objective prioritization process is part of the OU Director's performance plan. At the NIST level, the Program Office is continuing its restructuring to an analysis and evaluation office.
- *The VCAT recommends that the ongoing review of the existing Gaithersburg infrastructure be updated annually for relevance and fitness.*
 - NIST annually produces a Facilities Improvement Plan.
- *NIST Director is asked to ensure a full complement of VCAT membership.*
 - Agree. We are awaiting the paperwork from 2 candidates. With those – we currently have only 1 vacancy which I will fill.
- *The committee encourages that agenda time be spent periodically in this kind of dialogue [VCAT presenting to NIST].*
 - Agree. The agenda is set by VCAT Chair in consultation with NIST. Also – expect more dialogue as we structure around thematic subcommittees.
- *The Committee recommends that NIST do an analysis of its non-governmental partnerships to date, and seeks understanding and learning from those that are no longer functioning well.*
 - Last year we completed an analysis of JILA. Lessons learned were folded into the new JQI (primarily IP rights). CSTL is currently reworking its relationship with CARB. Industry relations are currently under review as we look towards new collaborations.

FY06 VCAT Recommendations (3 of 3)

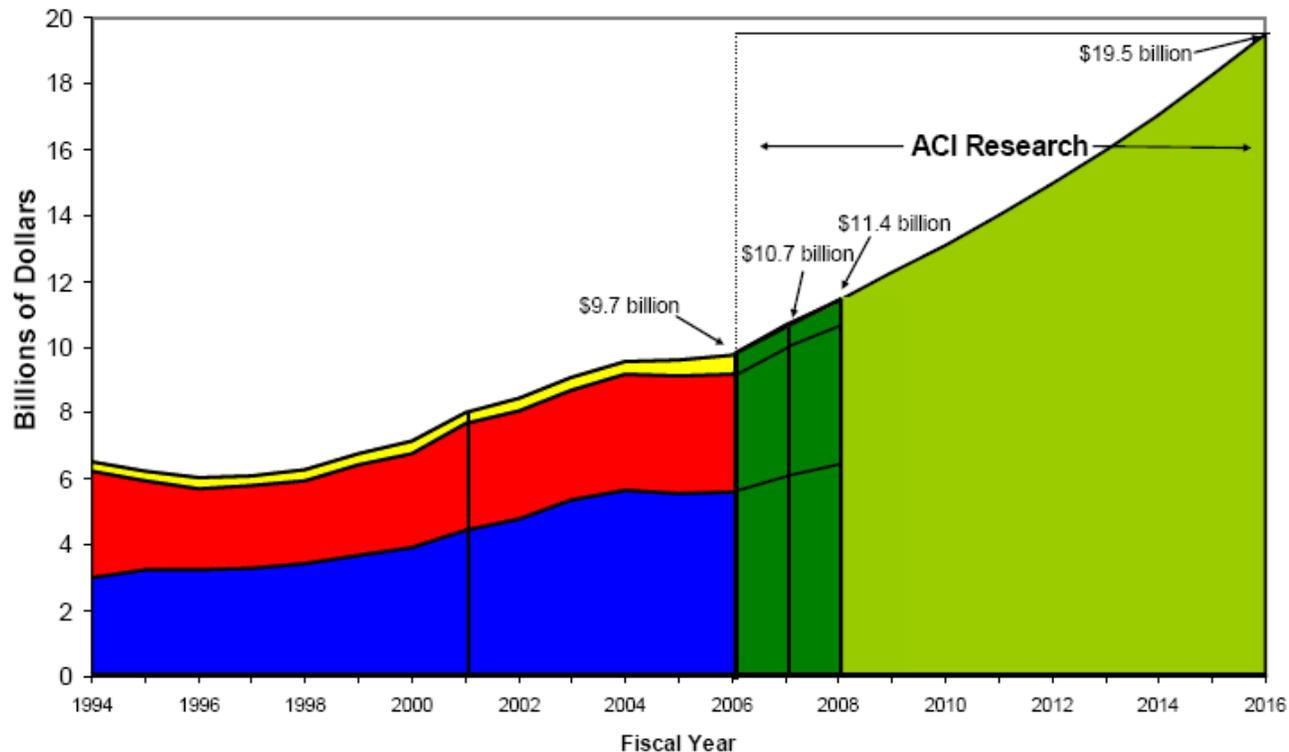
- *The Committee recommends that NIST continue to look for and to investigate ways to leverage itself with specialized contractor partners [for external drivers], with the goal of perhaps developing other service delivery mechanisms to prevent efforts becoming too diluted.*
 - Unsure of what this recommendation means. NIST currently leverages partners for many of its external drivers including disaster reconnaissance efforts and work under voting requirements.
- *VCAT encourages NIST to be proactive in its partnership with NCI and NIH related to measurements in the biological sciences.*
 - Partnerships will be based upon technical merit.
 - Examples of our current partnerships with HHS/NIH include:
 - Medical Innovation – HHS MOU (1/05)
 - Scientific Computing and Modeling – Center for Information MOU (3/05)
 - Nanotechnology Characterization Laboratory – NCI/FDA MOU (6/06-6/09)
 - Example Interagency Agreements
 - Proteomics Assessment – NCI (5/06, 5/07)
 - NCI's Early Detection Research Network – NCI (11/04-11/09)
 - Development of Reference Materials:
 - Dietary Supplements, Vitamins, and Metabolomics – Office of Dietary Supplements and National Institute of Diabetes and Digestive and Kidney Diseases (2002 - 2007)
 - Personnel Sharing/Exchange:
 - NIH/NIST Joint Fellowship Program (began 8/03; 5 Postdocs per year)
 - NIST staff detailed to NIBIB (3 in 2006)

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American Competitiveness Initiative (ACI)

- Proposed in FY 2007 and continued in FY 2008 budget
- Doubles, over 10 years, investment in:
 - NIST core (laboratory and infrastructure)
 - National Science Foundation
 - DOE Office of Science



NIST FY 2008 Budget Request (In millions of dollars)

	FY 2006 <u>Enacted</u>	FY 2007 <u>Enacted</u>	FY 2008 <u>Request</u>
STRS (w/o directed grants)	\$382.9	\$432.8	\$500.5
CRF (w/o directed grants)	<u>48.2</u>	<u>58.7</u>	<u>93.9</u>
NIST Core Total:	\$431.1	\$491.5	\$594.4

NIST Core	Δ (07-08) = +\$102.9 (21%)
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ITS	\$183.6	\$183.6	\$46.3
	(MEP+ATP)	(MEP+ATP)	(MEP)
Total NIST	\$614.7	\$675.1	\$640.7

Research and Facility Investments (\$M)

	<i>FY 2008</i>
<i>Research Initiatives (STRS)</i>	
Enabling Nanotechnology	+ \$6
Quantum Science	+ \$4
Climate Change: Measurements & Standards	+ \$5
Disaster-Resilient Structures & Communities	+ \$4
National Earthquake Hazards Reduction Program (NEHRP)	+ \$3.25
<i>SUBTOTAL</i>	+ \$22.25
Capacity and Capability Improvements Initiatives (CRF)	
NCNR Expansion/Reliability	+ \$19
Boulder – Building 1 Extension	+ \$28
<i>SUBTOTAL</i>	+ \$47
Rollover of Unfunded FY2007 Initiatives	<i>SUBTOTAL</i>
	+ \$33.65
<i>GRAND TOTAL</i>	+ \$102.9

Meeting National Priorities: NIST FY 2008 R&D Initiatives

Goal: Targeting High Impact Research (+\$22.25 million)

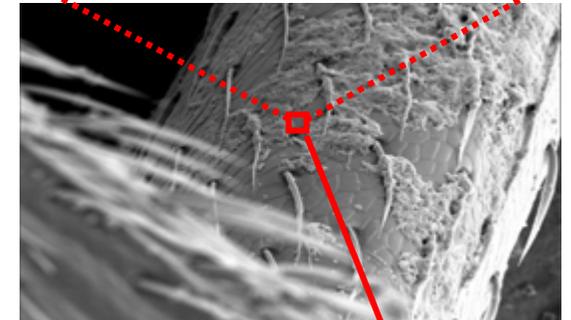
<i>R&D Priority</i>	<i>NIST Response (STRS)</i>
World-class capability and capacity in nanofabrication and nanomanufacturing (ACI Goal, NNI Strategic Plan, OMB/OSTP FY08 Priority Memo)	Enabling Nanotechnology from Discovery to Manufacture (\$6M)
Improve our understanding of climate variability and change (Global Climate Chg. Strategic Plan, OMB/OSTP FY08 Priority Memo)	Measurements and Standards for the Climate Change Science Program (\$5M)
Overcoming technological barriers to the practical use of quantum information processing (ACI Goal)	Quantum Science (\$4M)
Develop technologies and standards for improving structural performance during hazardous events (OMB/OSTP FY08 Priority Memo; ACI Goal; Subcommittee on Natural Disaster Reduction; NEHRP strategic plan)	Disaster Resilient Structures and Communities (\$4M)
	National Earthquake Hazard Reduction (\$3.25M)

Goal: Increasing Capacity and Capability (+\$47 million)

<i>R&D Priority</i>	<i>NIST Response (CRF)</i>
Improving capacity, maintenance, and operations of NIST labs (ACI Goal)	Boulder Building 1 Extension (\$28M)
Breakthroughs...through essential infrastructure such as the NCNR (ACI Goal, NSTC report)	NCNR Expansion and Reliability Enhancement (\$19M)

Enabling Nanotechnology from Discovery to Manufacture (+\$6M)

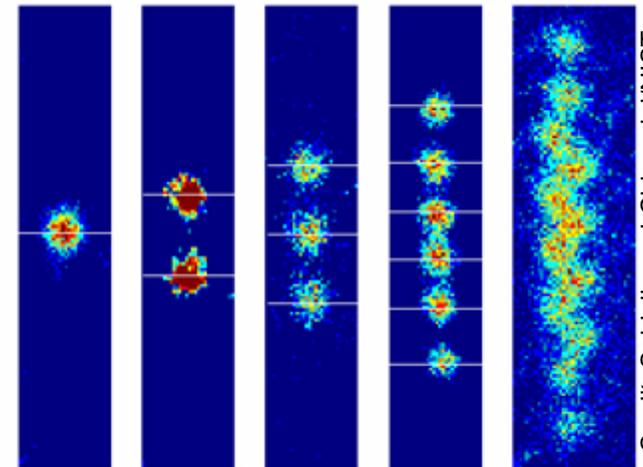
- Manufacturing with nanoscale components expected to be a dominant factor in the 21st century economy
- Exploiting nanoscale behaviors and properties requires new tools and methods
 - NIST is the NNI lead agency on “*Nanoscale measurement science, instrument calibration, standard reference materials, and nanoscale physical and chemical properties standard reference data.*”
- Initiative continues the creation of the Center for Nanoscale Science and Technology (CNST)
 - Partner with industry, universities, and other agencies to bridge the gap between science and production
 - Over 300 new researchers from industry and academia
- Expands research to support industry through nanoscale measurement science and standards
 - Develop new atomic-scale measurement capabilities
 - Support standards for environment, health, and safety



Carbon nanotube on the hair of an ant's leg

Quantum Science: Infrastructure for 21st Century Innovation (+\$4 million)

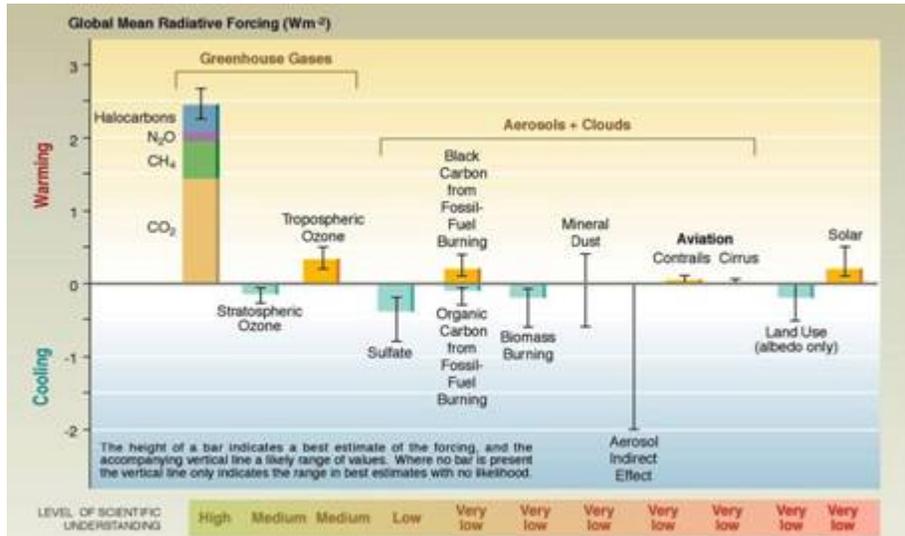
- **The laws of physics are fundamentally different in the quantum world of atoms, electrons, and light particles. This enables revolutionary potential for:**
 - Measurement capabilities otherwise impossible “classically”
 - “Unbreakable” codes (i.e. to protect financial transactions)
 - Powerful computers capable of solving problems impractical to solve today
- **NIST is a recognized world leader in the field**
- **This initiative will**
 - Accelerate the economic potential for exploiting the unique properties of the quantum world
 - Advance research on quantum information
 - Develop fundamentally new and unique measurement tools and methods
 - Further leverage the partnership with the Joint Quantum Institute (NIST, Univ. of MD, and NSA)



Magnesium ions loaded into NIST's new planar ion trap.

Credit: Seidelin and Chiaverini/NIST

Measurements and Standards for the Climate Change Science Program (+\$5M)



- Critical measurement uncertainties in solar output and effects of aerosols limit Nation's ability to model global climate change

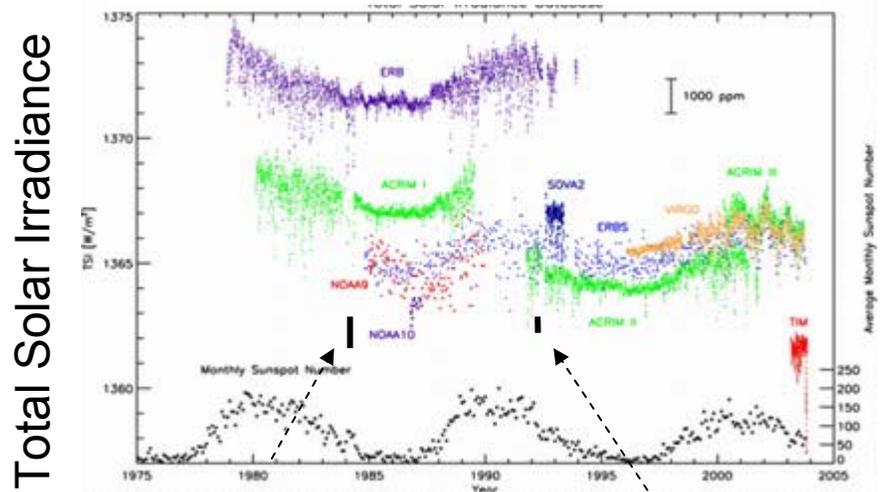
- Initiative addresses 2 critical gaps identified in Interagency Strategic Plan

- Resolves discrepancies in satellite-based measurements of solar intensity
- Provides quantitative understanding of effects of atmospheric aerosols on sunlight

- Results will help modelers to create an accurate picture of Earth's climate through calibrations traceable to international standards

- Standardized instrument calibration for satellites for accurate international intercomparisons and lower uncertainties
- New measurement methods for aerosols
- Database of aerosol properties

Total Solar Irradiance Database

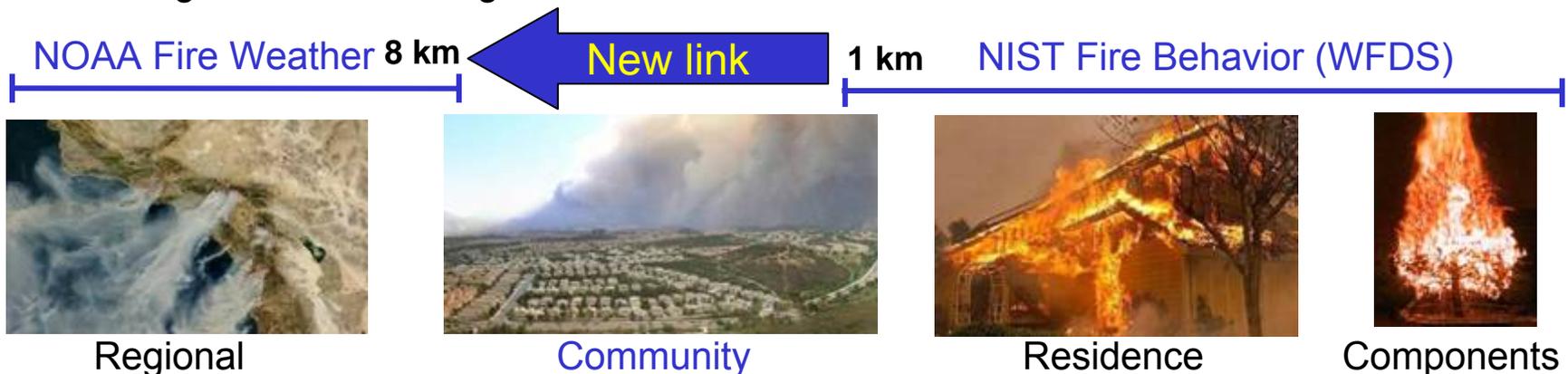


Target Accuracy $1 W m^{-2}$

Target Precision $0.3 W m^{-2}$

Disaster-Resilient Structures and Communities (+\$4M)

- Risk to lives, property, and major disruption of commerce increases as communities encroach on hurricane-prone coasts and fire-prone wildland-urban interface regions
- Single major event (e.g., hurricane) can cost \$80B-\$200B
- Need to assess community and regional scale risks
- This initiative will develop predictive tools that enable:
 - Local officials to evaluate and mitigate risks via land-use planning and practices;
 - Development of risk-based hazard maps at the community-scale; and
 - Development of risk-consistent and cost-effective mitigation solutions incorporated into next-generation building codes and standards.



Predict fire behavior for communities based on fuel maps, local topography, cultural features, and micro wind patterns for real-time firefighting as well as improved building codes and community planning.

National Earthquake Hazards Reduction Program (NEHRP) (+\$3.25M)

- Earthquakes strike without warning – and a single major event can cost \$100B - \$200B
- 75 million Americans and \$8.6 trillion worth of structures in the U.S. in moderate to high-risk areas
- NIST tasked with conducting research to bridge the gap from construction theory to practice and to promote its adoption
- This initiative will enhance the safety of:
 - New structures by establishing and promoting performance-based standards for entire building designs and by accelerating the adoption of basic research into the model building codes, standards, and practices
 - Existing structures through research on actual building performance in earthquakes; developing structural performance models and tools; and establishing cost-effective retrofit techniques for existing buildings



1994 Northridge Earthquake,
Los Angeles (NIST)

NIST Center for Neutron Research (NCNR) Expansion and Reliability Improvements (+\$19M CRF – Year 2)

■ Neutron-based measurements are critical for 21st century innovation – for example:

- Design of new medications by determining protein structure & function
- Development of practical alternative energy sources
- Determining the structure of materials and devices at the nanometer scale
- Discover advanced new materials for technologies beyond semiconductors

■ Due to tremendous scientific value – demand for access by industry and academia far exceeds capacity

■ NCNR serves more customers than all other U.S. neutron facilities combined – and this initiative will:

- Further increase capacity by 30% to serve 500 additional researchers each year
- Add additional cold source and new guide hall
 - New cold source is 2x brighter; Guide system is up to 4x more efficient
- Provide new generation of world-class instruments
 - Critical new instruments either not available in U.S. or 100x improvement



photo © Robert Ralhe

Boulder Laboratories: Building 1 Extension (+\$28M)

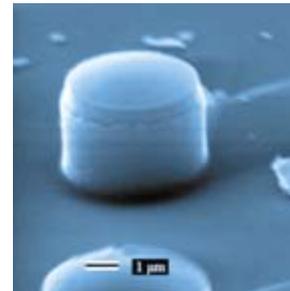
- Modern measurement science requires extremely advanced capabilities such as manipulating objects at the atomic scale
- The 1950s infrastructure in Boulder is insufficient to meet the Nation's needs for increasingly accurate measurements

- High speed/high frequency measurements required for advanced electronics, defense, and homeland security;
- Measurements and tests at the single atom level;
- Measure forces below 1 billionth of a penny's weight: forces between cells, nanoscale systems, etc;
- Measure time to 1 second in 30 billion years enabling new science and vastly improved navigation/positioning systems

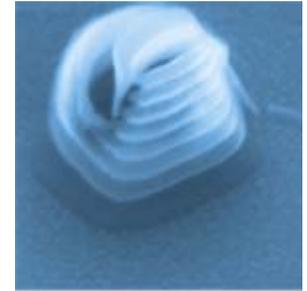
- **Create a 21st-century measurement capability for the Nation**

- Construct a high-performance laboratory extension to existing Building 1 with stringent control of temperature, vibration, humidity, and air cleanliness.
- Deliver higher performance laboratory space sooner and at lower cost than previous plans

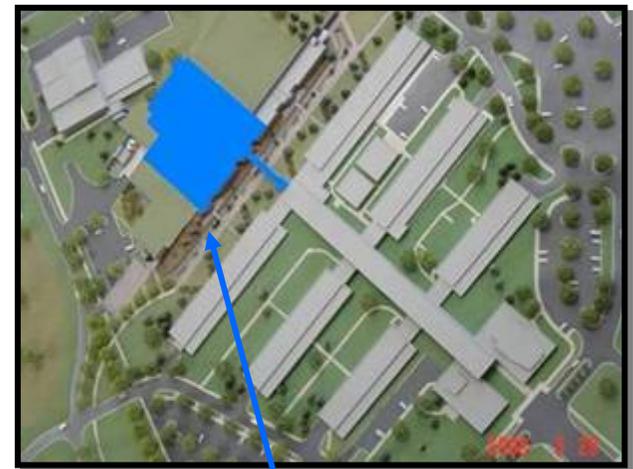
Nanofabrication Capabilities



Adequate Control:
Working Device

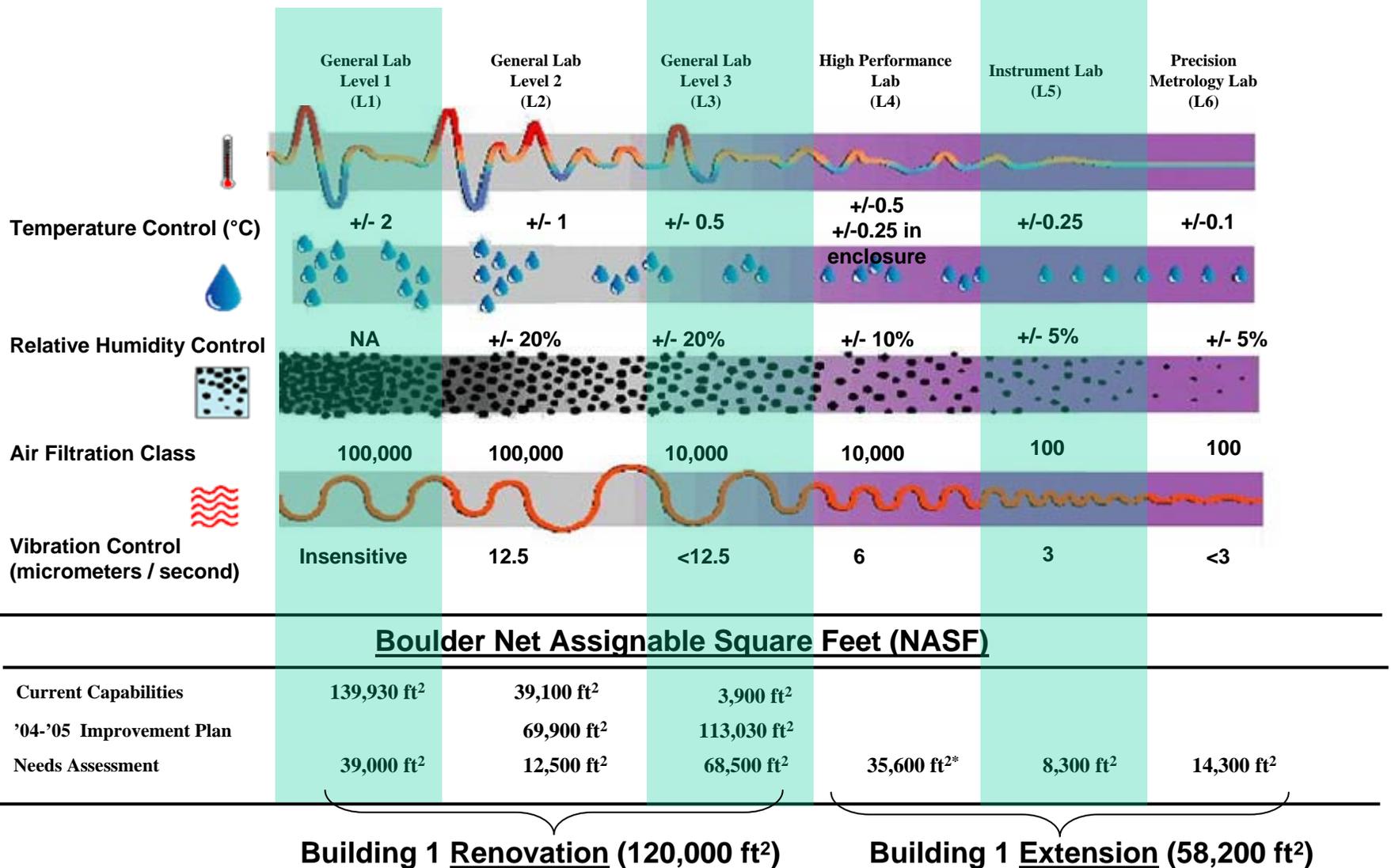


Poor Control:
Non-working device



Extension

Required Environmental Controls



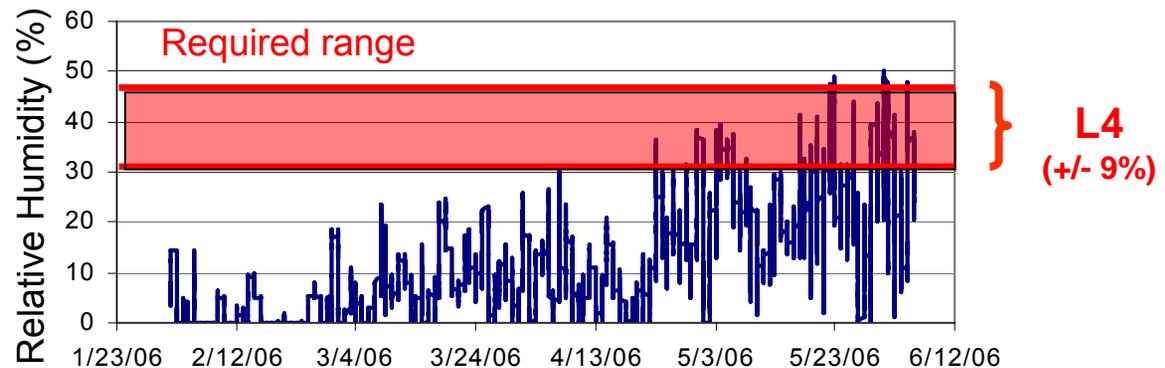
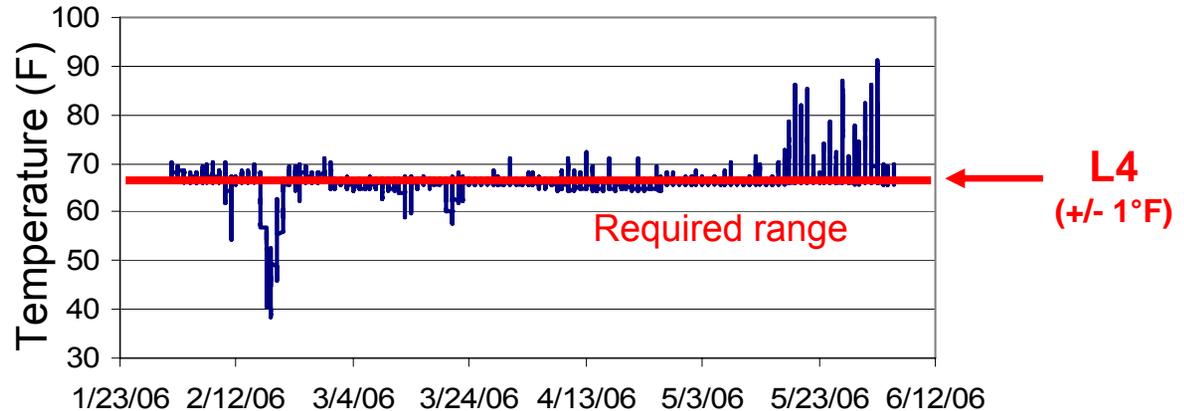
*10,200 ft² would be built at L4 and initially used to meet L3 needs

Environmental Factors Impact Microfabrication Laboratory Performance

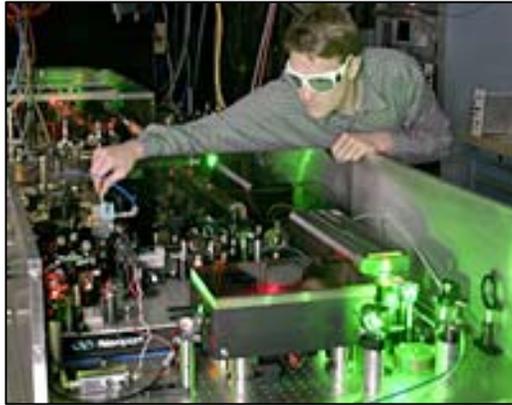
Microfabrication Performance Requirements



Good control of microfabrication lab environment required to make devices for research and measurements in quantum computing, quantum communications, new types of lasers for medical applications, sensors for homeland security, etc.

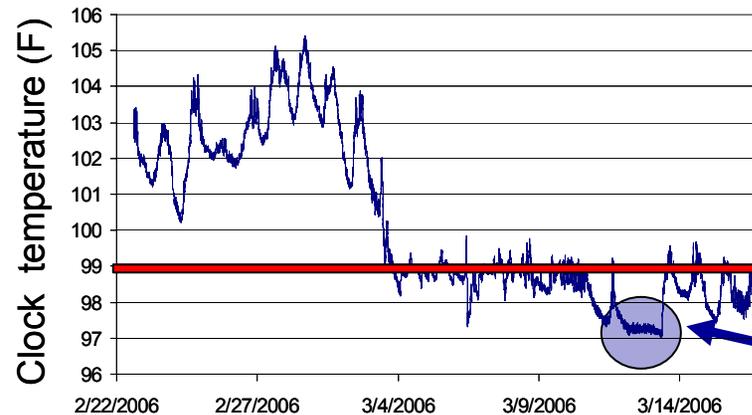


Atomic Clock Research Severely Impaired by Lab Temperature and Vibration Problems



- Critical national needs require 10,000 times better timing precision than current laboratories can deliver.
- Temperature drifts cause errors in atomic clock timing.
- Current conditions often require a full week of continuous measurement to get one hour of useful data (about 1% productivity).

Capabilities



Temperature fluctuations cause measurement error of 1000's picoseconds/day

Brief period where temperature stability approached current needs

Needs

Technologies critical to economic security and national defense

(advanced GPS, advanced Telecom, astronomy, deep space exploration, gravimetry)

Required atomic clock precision

Current: 10 picoseconds/day
Future: 0.1 picoseconds/day

Required Laboratory Performance

$\pm 0.2^\circ\text{F}$

L5/L6

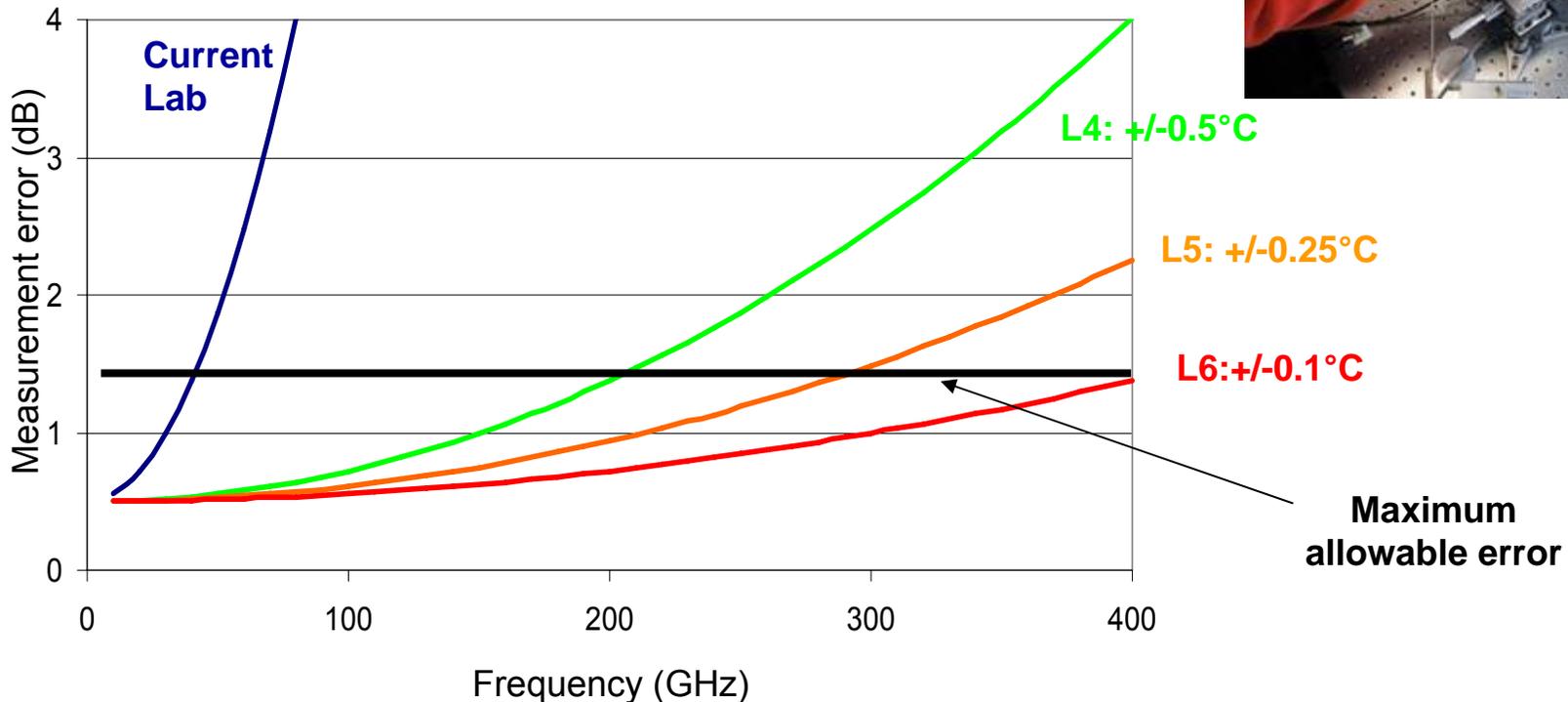
Critical High-Speed Electronic Measurements Limited by Lab Temperature Fluctuation

High-speed measurements needed for:

- Future telecommunications networks
- High-speed computing
- New radars and sensors



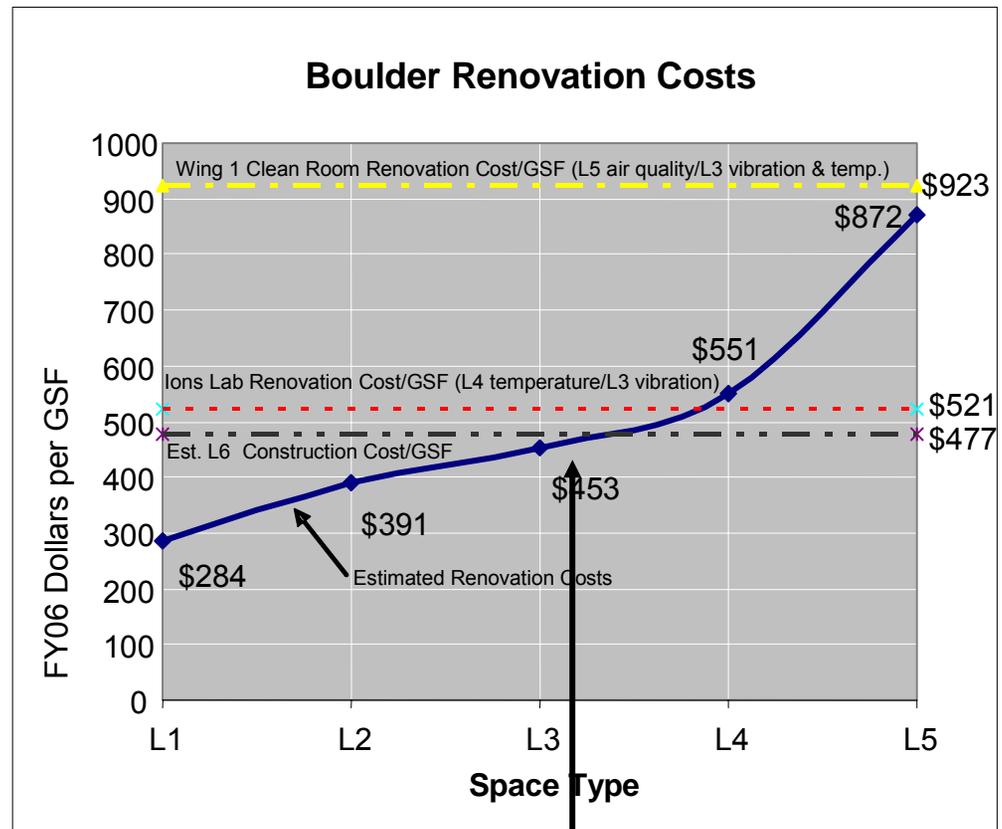
Measurement error caused by temperature drift



Comparison of Alternatives: Based on Analysis and Experience

- A facilities review was conducted in NIST-Boulder by a team that represented scientists, budget, and facilities and is based on:

- Lessons learned from previous projects (AML);
- Historical cost data from projects completed at the NIST-Boulder site;
- Cost data from similar, non-federal, construction projects;
- Consultation with a qualified A/E firm on estimated costs; and
- Design information and cost data previously provided to NIST by qualified A/E firms.



Above L3 it is cheaper to build new versus renovate

Budget Summary

- **The proposed FY 2008 budget is an excellent budget**
 - Enhances NIST's ability for world-class research on measurement problems that impact our Nation's economic security and quality of life;
 - Provides the facility capabilities necessary to carry out our mission well into the future; and
 - Shows continued strong support for our Nation's science and technology

Outline

Welcome & Update

NIST Expectations of VCAT

FY06 Report / Recommendations

FY08 Budget Request

What is NIST?

NIST Has Two Main Campuses...

Gaithersburg, MD



Boulder, CO



- 2,800 employees
- ~2,500 associates and facility users
- NIST Research Laboratories
- Hollings Manufacturing Extension Partnership
- Baldrige National Quality Award
- Advanced Technology Program

NIST has...

...four joint institutes



JILA

NIST + University of Colorado

**Center for Advanced Research
in Biotechnology (CARB)**

NIST + University of Maryland



Joint Quantum Institute

NIST + University of Maryland + NSA

Hollings Marine Laboratory
NIST + NOAA + South Carolina DNR
+ College of Charleston
+ Medical University of South Carolina



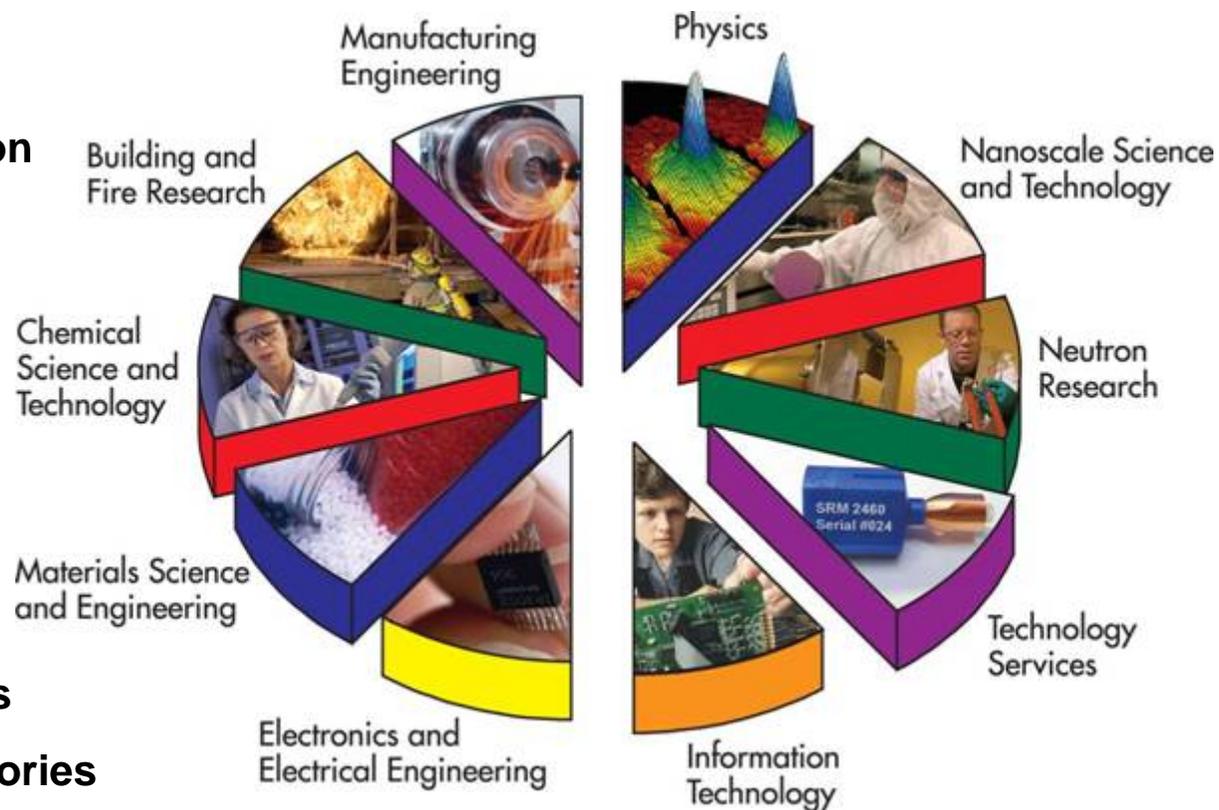
The NIST Laboratories

NIST's work enables

- Science
- Technology innovation
- Trade
- Public benefit

NIST works with

- Industry
- Academia
- Other agencies
- Government agencies
- Measurement laboratories
- Standards organizations



Hollings Manufacturing Extension Partnership

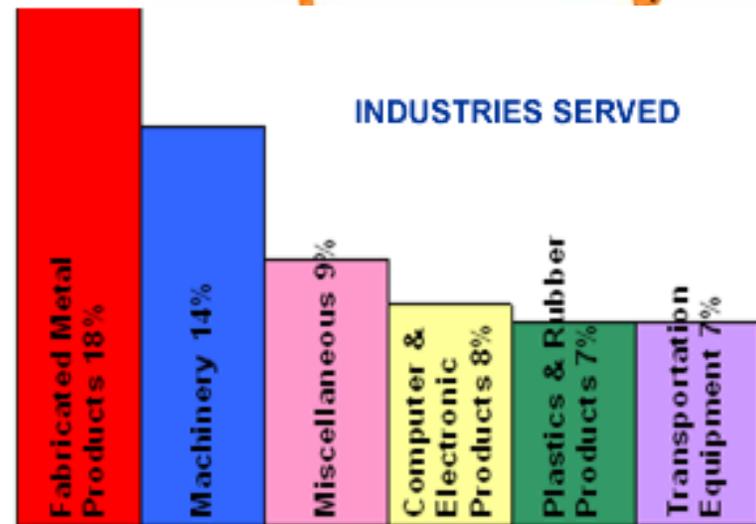
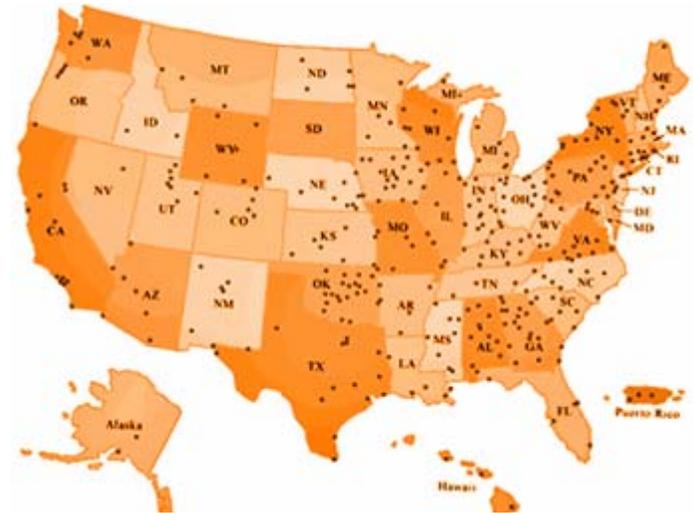
The MEP is a nationwide network that provides hands-on help to smaller manufacturers.

Business assistance includes:

- Quality management
- Human resource development
- Financial planning

Technical assistance includes:

- E-commerce
- Process improvement
- Plant layout
- Product development
- Energy audits



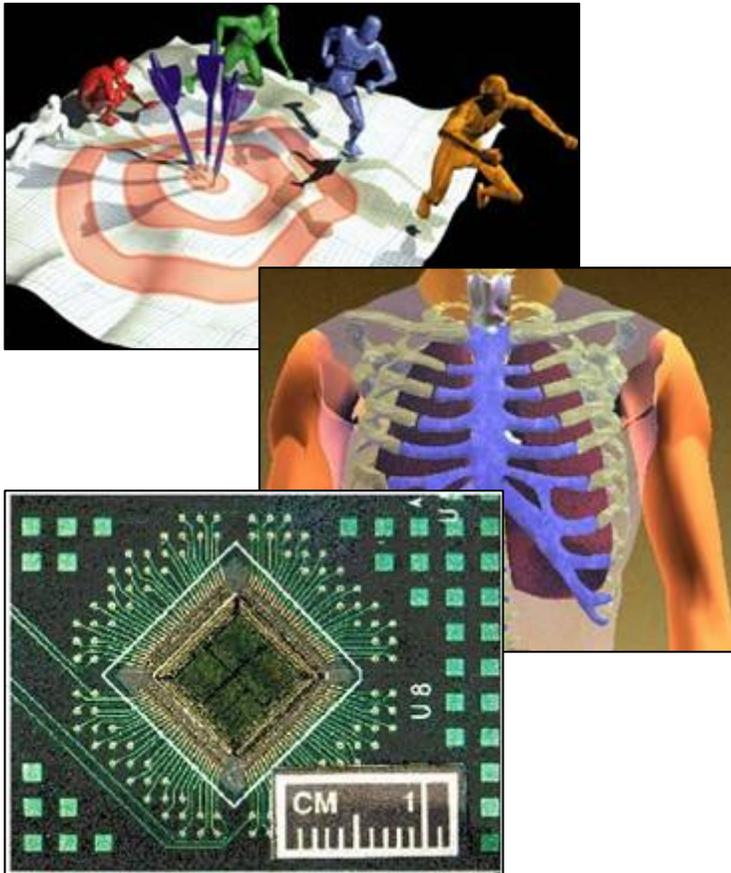
355,000 small U.S. manufacturers produce 55% of value added in manufactured goods, employ more than 12 million workers

Advanced Technology Program



Co-funding of private sector R&D to accelerate the development of high-risk, broadly enabling technologies.

IT, electronics, materials, biotechnology, tissue engineering, DNA chips, etc.



www.atp.nist.gov

Baldrige National Quality Program



- Premier U.S. program for performance excellence and quality achievement.
 - Awards in manufacturing, service, small business, education, health care, and non-profit organizations.
 - More than 1 million copies of Criteria for Performance Excellence downloaded annually
-
- Quality programs modeled on Baldrige: 55 state and local (up from fewer than 10 in 1990); 60 international.



Credit: Ron Bell/DOC

Vice President Cheney; 2005 Baldrige Award Winners; Commerce Secretary Carlos Gutierrez; and Baldrige Foundation Chairman Dale Crossover.

NIST has...

...world-class staff



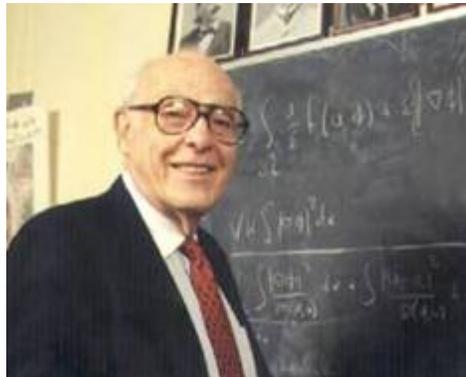
Jan Hall
2005 Nobel Prize
in Physics



Eric Cornell
2001 Nobel Prize
in Physics



Bill Phillips
1997 Nobel Prize
in Physics



John Cahn
1998 National Medal of
Science



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



Debbie Jin
2003 MacArthur
Fellowship

Nation's Infrastructure

When things go well...



(Before 2003 blackout)



When things go wrong...



(During blackout)



NIST Mission

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

NIST 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.

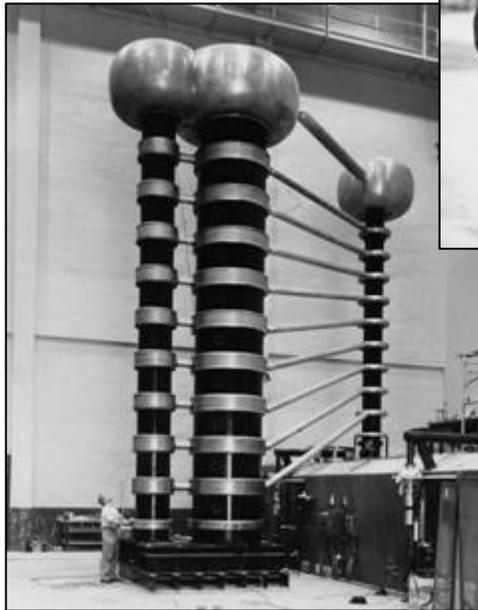
NIST-wide Core Competencies:

- *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)

Extreme Measurements

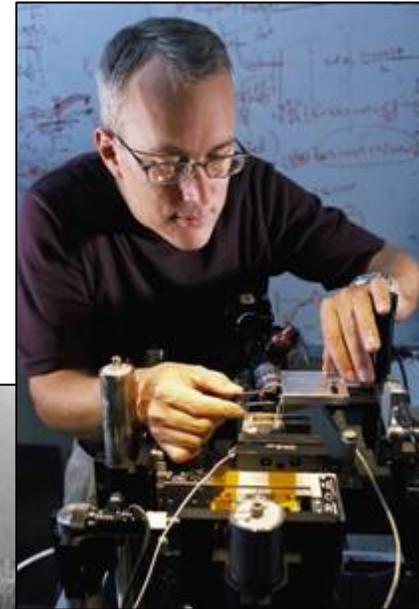
1959



1940



1968



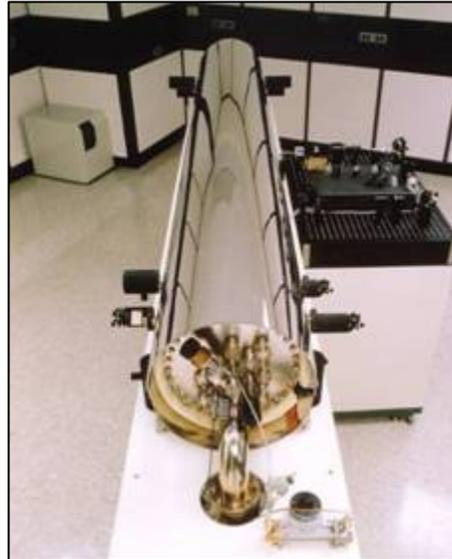
2006

Time Marching On ...



Ammonia resonator

1s in 300 years
(1949)



NIST 7

1s in 6 million years
(1993)



NIST F1

1s in 60 million years
(1999)



Optical clock:

Potential accuracy of
1s in 30 billion years

Consumers Count on Standards



Consumer Trust – ultimate references for \$5 trillion in annual sales based on measurement

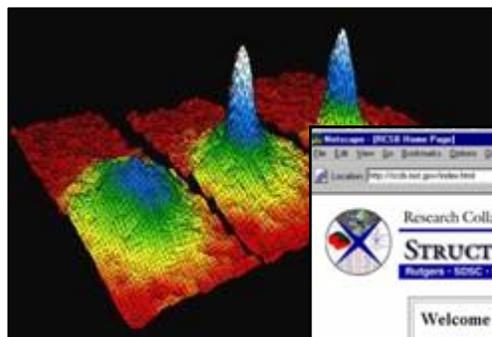
Integrity of Financial Transactions – time-stamping of stock trades, etc., totaling hundreds of billions of dollars daily



Secure Automated Banking – encryption technology embedded in nation's 300,000+ ATMs

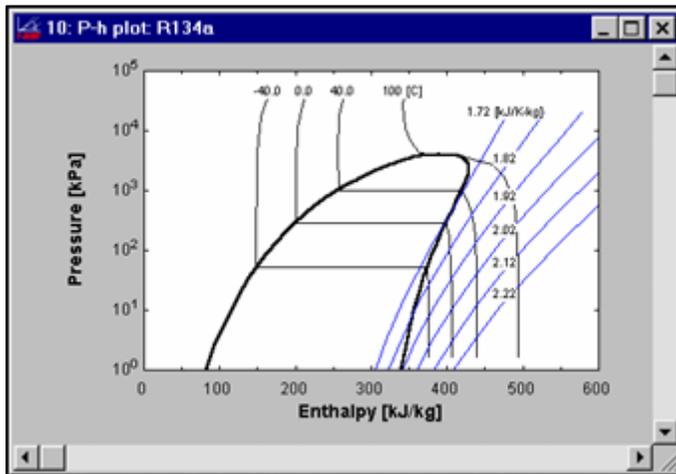
NIST Products and Services Include

- Measurement Research
2,200 publications/year
- Standard Reference Data
90 types available
94 million datasets downloaded/year
- Standard Reference Materials
>1,300 products available
31,200 units sold/year
- Calibrations and Tests
13,000 calibrations/year
- Laboratory Accreditation
819 accreditations
- Technical Workshops
>9,000 participants/year
- Standards Committees
1324 members, 972 committees,
161 chairs, 98 SDOs



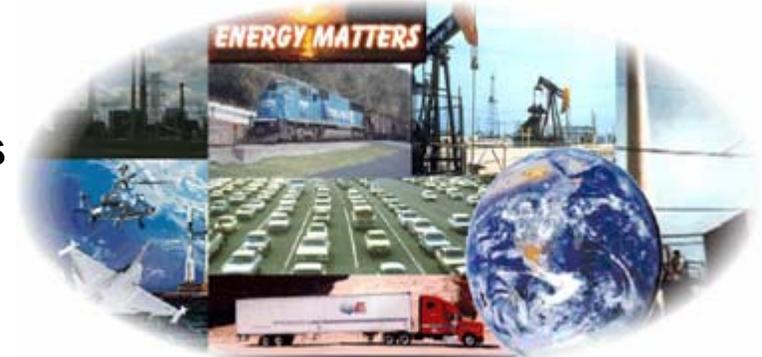
Economic Impact Assessment Studies

**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

NIST Center for Neutron Research



Preservation of pharmaceuticals

- National resource for neutron-based measurements
- “See” structure at the nanoscale
 - Uniquely sensitive to hydrogen
 - Probe magnetic structure
 - Non-destructive probe



Magnetic data storage



Chemistry of cement



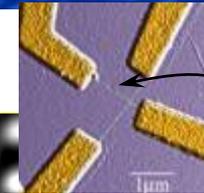
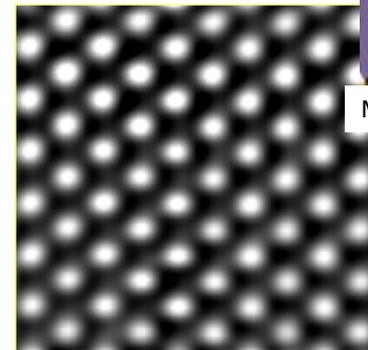
Petrochemicals



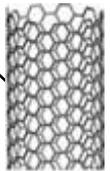
Fuel cells
H₂ storage materials

Center for Nanoscale Science and Technology (CNST)

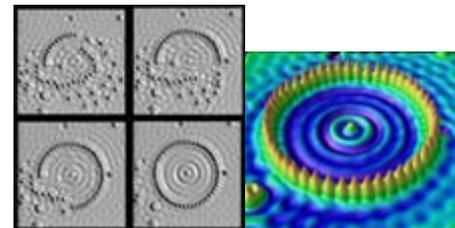
- New multidisciplinary center aimed at converting nano discovery to products
- Mission: develop the necessary measurement science and instrumentation to meet emerging needs
- Establish the materials and process characterization to enable scaled-up, reliable, cost effective manufacturing of nanoscale materials, structures, devices, and systems
- Partner with industry, academia, and government to turn the potential of nanotechnology into reality



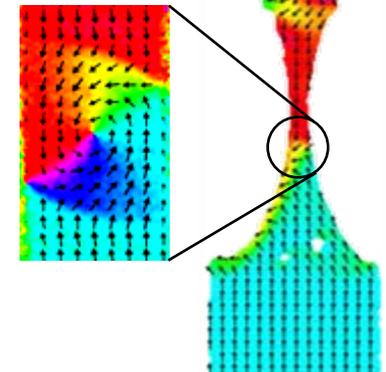
Nanotube electrode



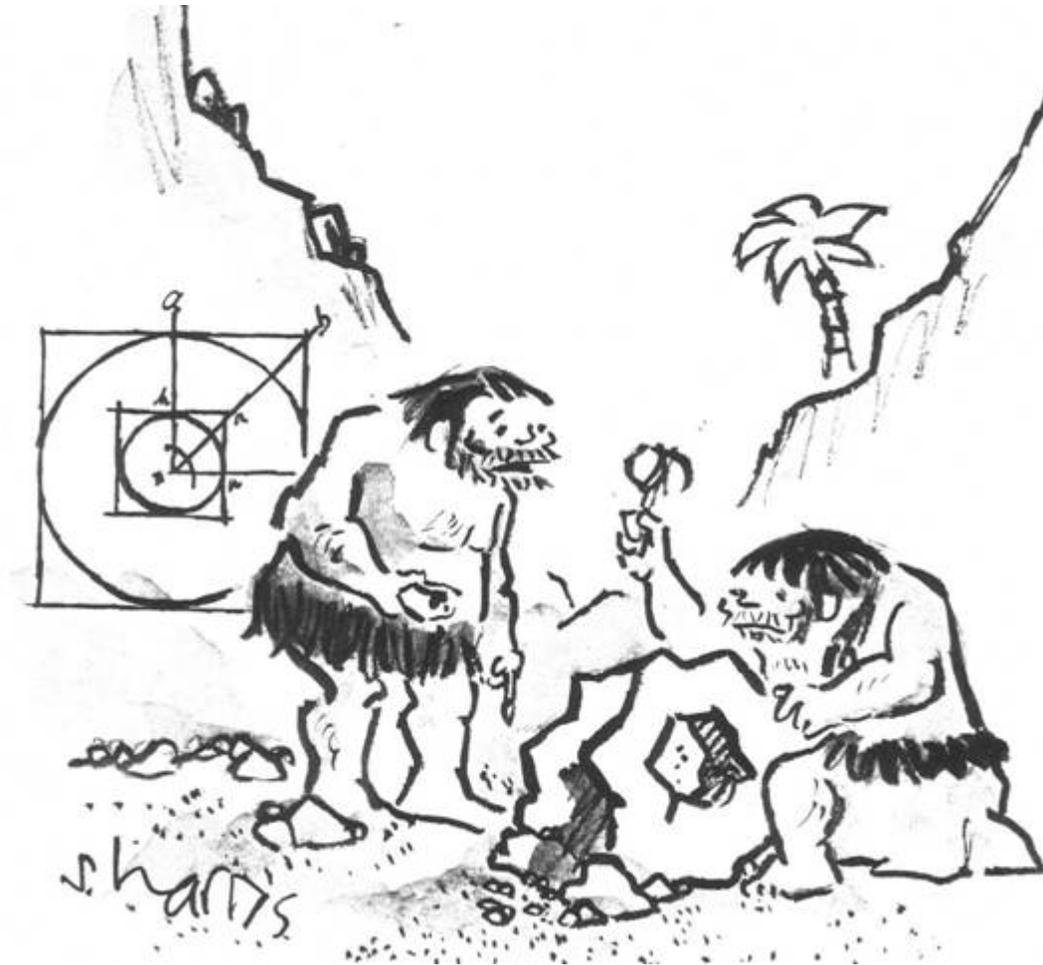
Carbon nanotube
~1.3 nm diameter



Quantum corral of 48 iron atoms on copper surface
Corral diameter 14 nm



NIST: Closing the Gap Between Science & Technology...



"I guess there'll always be a gap between science and technology."

VCAT Agenda

Tuesday, March 6

- Welcome
- NIST Update
- Nanotechnology Status
- Biosciences/Health Care Status
- Laboratory Tours
 - Environmental Health, and Safety Measurement Science and Standards Research for Nanotechnology
 - Designer Ion Beams for Next-Generation Custom Nanofabrication
- Break-out Sessions with VCAT Subcommittees
 - VCAT Subcommittee on Nanotechnology
 - VCAT Subcommittee on Biosciences/Health Care

Wednesday, March 7

- Roundtable Discussion : Subcommittee Thematic Overviews