

# NIST Update



Dr. James Turner  
Acting Director  
December 2007

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

**NIST**

National Institute of  
Standards and Technology

U.S. Department of Commerce

# Welcome...

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## **Background of Hollings Marine Laboratory**

- Established: December 21, 2000; 8-acre site
- Mission: Promotes scientific research to sustain, protect, and restore coastal ecosystems
- Partnership of governmental and academic agencies:
  - NOAA's National Ocean Service
  - NIST
  - South Carolina Department of Natural Resources
  - College of Charleston
  - Medical University of South Carolina
- Full briefing later today

# Outline

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## ➤ **Update VCAT Role**

- NIST Recognition – External and Internal
- Technical Highlights
- Outreach and Partnership Activities
- Evaluation of NIST Programs
- FY 2008 Budget and Strategic Plans & Beyond

# Appreciation Exiting VCAT Members

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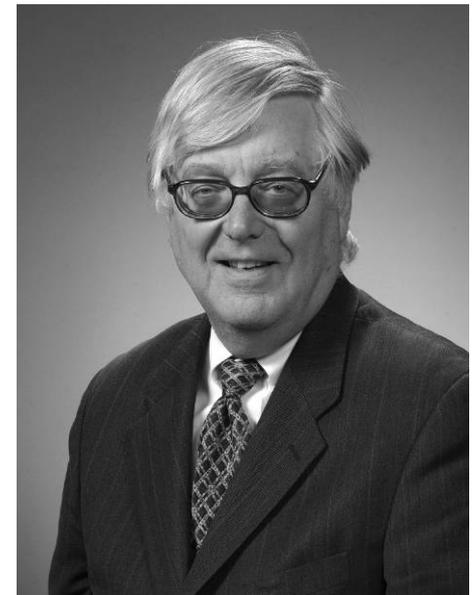
## **E. DAVID SPONG**

### **Chair of Visiting Committee**

Term: March 11, 2005 – January 31, 2008

Contributions include:

- VCAT Vice Chair, Nov. 05 – Sept. 06
- Established subcommittees for Nano, IT, and Bio
- VCAT Panel on Best Practices for Organizational Development
- Advice on Organizational Excellence
- Long-term dedicated service to the MBNQA including Foundation Chair



## **JOHN F. CASSIDY**

Term: March 11, 2005 – January 31, 2008

Contributions include:

- Member of VCAT Nanotechnology Subcommittee
- VCAT Panel on Best Practices for Strategic Planning
  - Advice on NIST's Role in the Global Economy

# Appreciation Exiting VCAT Members

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## **GARY D. FLOSS**

Term: May 22, 2002 – January 31, 2008

Contributions include:

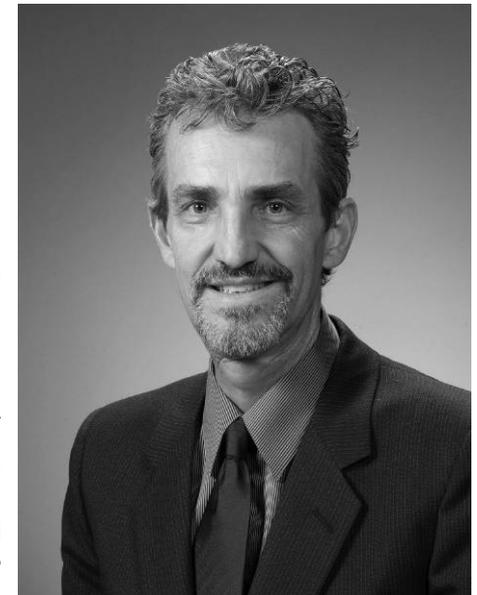
- Member of VCAT IT Subcommittee
- VCAT Panel on Best Practices for Strategic Planning
- VCAT Panel on Best Practices for Organizational Development
- Advice on Performance Measures and NIST Balanced Scorecard

## **W. WYATT STARNES**

Term: March 11, 2005 – January 31, 2008

Contributions include:

- VCAT IT Subcommittee Chair
- VCAT Panel on Best Practices for Organizational Development
- VCAT Panel on How to Maximize NIST Impact on U.S. Innovation
  - Advice on NIST's Role in IT



# 2007 VCAT Report

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*“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.”*

## **Considerations for the 2007 VCAT report:**

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. Requirement for 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. Report due no later than 30 days after budget submission (110-69 SEC. 3005)
  - Must comment on FY2009 budget and NIST Planning Report
  - May require additional meeting after release of President’s budget

# VCAT 2008 Plans

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- Goal is to fill all VCAT vacancies to reach 15 members
- Membership renewals will now be done by rare exception, most members will only serve one three-year term
- VCAT now mandated to meet “at least twice each year” (PL 110-69 SEC. 3006)
- Formulation of 2008 agenda
  - Priorities for NIST and VCAT
  - Structure of VCAT

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- **NIST Recognition – External and Internal**
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# 2007 Presidential Rank Awards

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



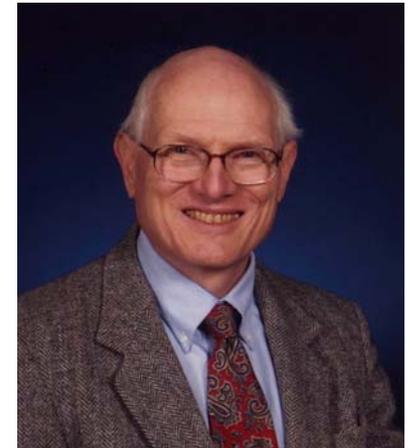
Charles W. Clark  
*Distinguished*



Richard Kayser  
*Meritorious*



William J. Boettinger  
*Meritorious*



Paul S. Julienne  
*Meritorious*

# Presidential Early Career Award for Scientists and Engineers (PECASE) Awards

The nation highest honor for outstanding scientists and engineers at the start of their research careers who show exceptional promise for leadership at the frontiers of scientific knowledge

Joshua C. Bienfang  
*Quantum cryptography  
(Joshua's work set the  
record for speed of  
quantum key  
generation and distance  
of transmission)*



Kathryn L. Beers  
*Nanomaterials  
(currently on  
assignment to OSTP)*

# 2007 DoC Gold Medal Recipients



## Leadership

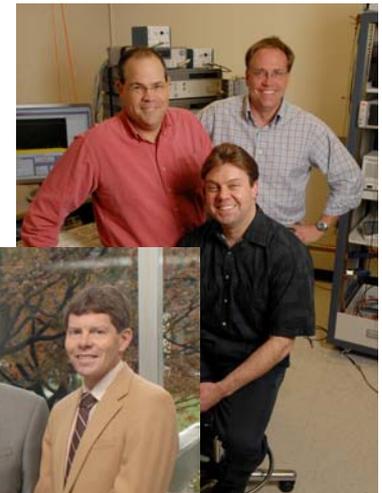
William Barker, Ramaswamy Chandramouli, James Dray, Jr., Hildegard Ferraiolo, William MacGregor, Donna Dodson, Teresa Schwarzhoff, Timothy Grance, Patrick Grother, William Polk

*For leadership in producing the standards, guidelines, and test programs required to implement Homeland Security Presidential Directive 12.*

## Scientific/Engineering Achievement

Samuel P. Benz, Paul D. Dreselhaus, Joseph R. Klinard, Jr., Thomas E. Lipe, Jr. Yi Hua Tang, Charles J. Burroughs. Jr.

*For the landmark development and dissemination of the world's first quantum-based electrical standard for AC voltage.*



# 2007 DoC Gold Medal Recipients

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## **Scientific/Engineering Achievement**

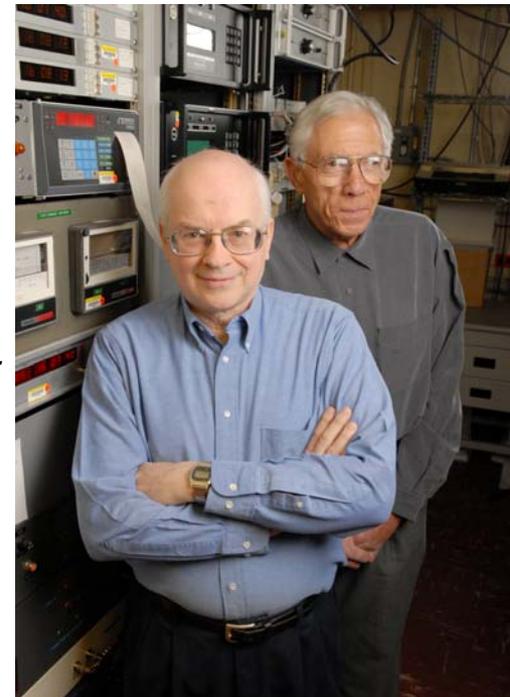
Taner Yildirim

*For scientific breakthrough in the creation and characterization of nano-structured materials for safe and efficient solid-state hydrogen storage.*

## **Scientific/Engineering Achievement**

Thomas E. Parker, Judah Levin

*For leadership of the NIST time scale, the source of all NIST time and frequency measurements used billions of times each day.*



# 2007 DoC Gold Medal Recipients



## **Customer Service**

Joy P. Dunkers, Michael H. Francis, Jeffrey R. Guerrieri,  
Gale A. Holmes, Walter G. McDonough, David R. Novotny,  
Chad R. Snyder, Perry F. Wilson

*For creating and implementing the rigorous testing protocols  
and benchmarks needed to ensure the security and integrity  
of the new U.S. ePassport.*

# Administration Changes...



Acting Director  
**James Turner**



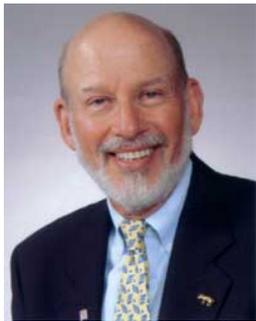
Acting Deputy Director  
**Richard Kayser**



Chief Facilities  
Management Officer  
**Estella Fiotes**



Center for Nanoscale  
Science and Technology  
Director  
**Robert Celotta**



Technology  
Innovation Program  
Acting Director  
**Marc Stanley**



Member (DoC/NIST)  
of HHS American  
Health Information  
Community (AHIC)  
**Cita Furlani**



Manufacturing  
Engineering Lab.  
Acting Director  
**Howard Harary**



Materials Science and  
Engineering Lab.  
Acting Director  
**Eric J. Amis**

# Outline

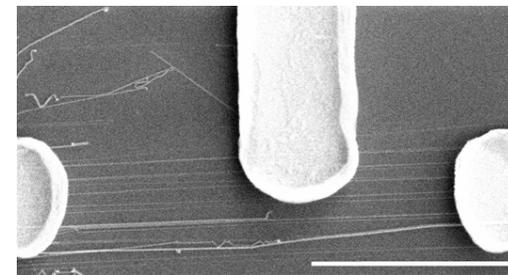
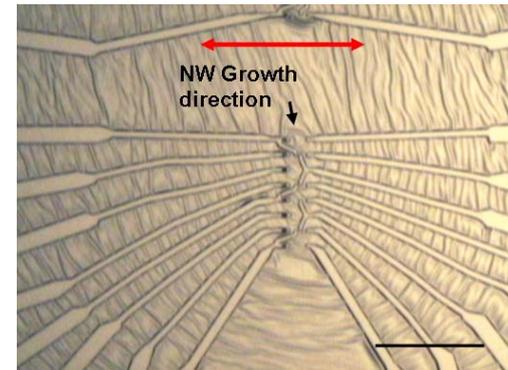
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- Update VCAT Role
- NIST Recognition – External and Internal
- **Technical Highlights**
- Outreach and Partnership Activities
- Evaluation of NIST Programs
- FY 2008 Budget and Strategic Plans & Beyond

# Technical Highlights ... *Rapidly Developing Technologies*

## NIST Demos Industrial-Grade Nanowire Device Fabrication

- NIST researchers have developed a technique that allows for the selective growth of nanowires on sapphire wafers.
- Conventional semiconductor manufacturing techniques were used to deposit small amounts of gold in precise locations on a sapphire wafer. This procedure creates more than 600 nanowire-based transistors in a single process.
- New technique should allow industrial-scale production of nanowire-based devices.



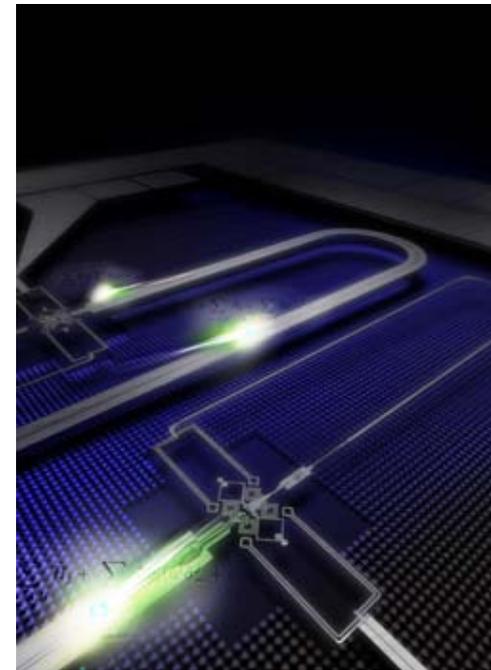
Nanowire electronics: (Top) Optical image shows metal electrodes attached to zinc oxide nanowires using the NIST technique. Dark spots near the center are the gold pads that start nanowire growth; red arrow shows direction of growth. Scale bar is 50 micrometers long. (Bottom) Scanning electron microscope image shows electrodes connected to group of nanowires. Scale bar is five micrometers long.

# Technical Highlights ... *Rapidly Developing Technologies*

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## Superconducting Quantum Computing Cable

- NIST physicists have transferred information between two “artificial atoms” by way of electronic vibrations on a microfabricated aluminum cable.
- This success has demonstrated a new component for ultra powerful quantum computers of the future. It includes superconducting circuits with zero electrical resistance, and multi-tasking data bits.
- The resonant cable might someday be used in quantum computers to carry out code-breaking and database searches exponentially faster than today’s most powerful computers.

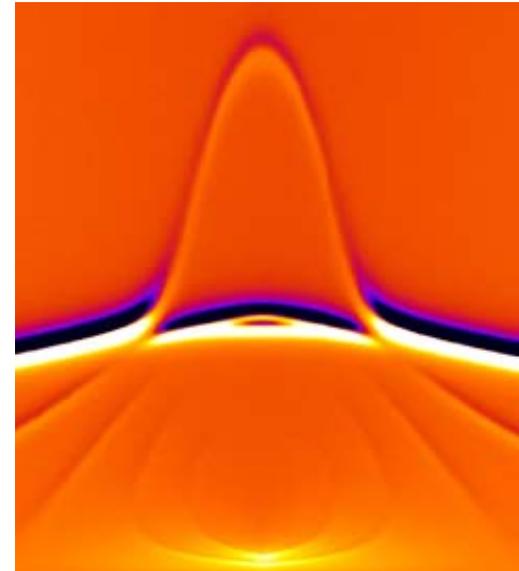


Artist's rendition of the NIST superconducting quantum computing cable.

# Technical Highlights ... *Rapidly Developing Technologies*

## Measurements from the Edge: Magnetic Properties of Thin Films

- NIST material researchers, together with colleagues from IBM and MIT, have produced the first data on how the edges of metallic thin films contribute to their magnetic properties.
- This technique has been used to measure how the magnetic properties of the thin film edge are affected by the thickness of the film and processing conditions during the strip patterning.
- The results may impact the design of future nanoscale electronics.

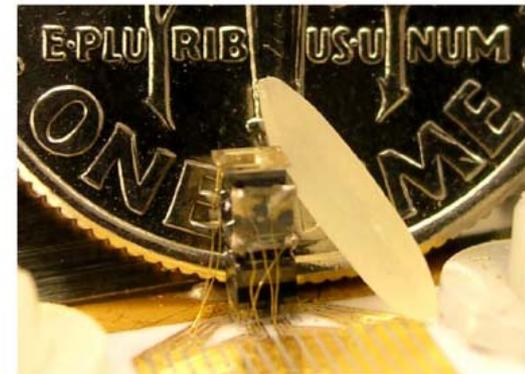
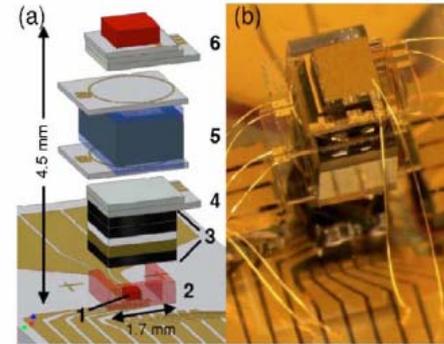


Spectroscopic image showing the microwave-frequency magnetic resonances of an array of parallel, metallic thin film nanowires ("stripes"). The peak in the center is due to resonances occurring at the stripe edges while the strong horizontal bar is due to resonances in the body of the stripes.

# Technical Highlights ... *Rapidly Developing Technologies*

## Mini Magnetic Sensor May Have Biomedical, Security Applications

- NIST and its collaborators have developed a magnetometer the size of a grain of rice.
- The sensor could be battery-operated and could reduce the costs of noninvasive biomagnetic measurements. The device also may have homeland and national security applications related to screening for explosives, perimeter security, etc.



Photomicrograph of the physics package of a NIST chip-scale atomic magnetometer (CSAM), with a schematic diagram. (1) Laser. (2) Spacer. (3) Optics. (4) Heater. (5) Vapor cell with rubidium atoms. (6) Detector. For scale, a CSAM is shown next to a dime and rice grain.

# Technical Highlights ... *Responding to National Needs*

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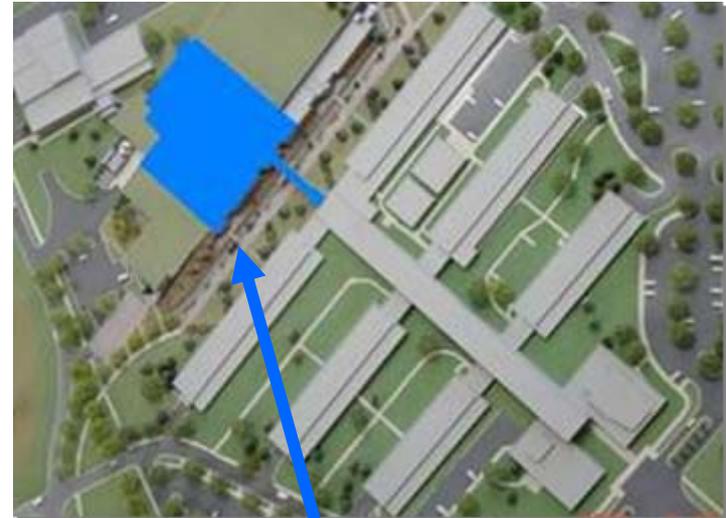
## Voting Standards Guidance Sent to Election Commission

- The Technical Guidelines Development Committee (TGDC), chaired by the NIST Director, submitted a 598-page report with recommendations for a new set of requirements intended to make voting systems more “secure, reliable, and easier for all voters to use.”
- The recommendations are a “complete rewrite” of similar guidelines issued in 2005 by the TGDC.
- The Election Assistance Commission is expected to conduct a series of public reviews of the TGDC’s recommendations, consider comments, and then issue a final “Voluntary Voting System Guideline” most likely in 2009.



# ACI Initiated Construction: B1/E Update

- Awarded construction management contract
- Completed bridging documents
- Awarded design-build contract
  - ~225,000 GSF (Gross Square Feet); 48,000 NASF (Net Assignable Square Feet) of instrument lab and clean room quality space
- Phased funding and construction
  - \$10.1M reprogrammed for design update, PCAS (Post Construction Award Services), labor
  - Phase 1: \$28.0M in FY08 (lab side only; warm lit shell suitable for office space)
  - Phase 2: \$38.1M in FY09 (office side and finish to lab quality space)
- MRAD (Mountain Region Acquisition Division) providing contract support
  - Project re-discovery and initiation completed August 2007
- Awarded task order for design update late September 2007
- Design update completion scheduled for April 1, 2008
- Procuring contract with local AE firm



Extension

# ACI Initiated Construction: NCNR Update

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As of end of FY07...

## Construction:

- Awarded construction management contract
- Completed bridging documents
- Awarded design-build contract

## Instruments:

- Held workshop with US researchers
- Developed/analyzed conceptual designs

## Guides:

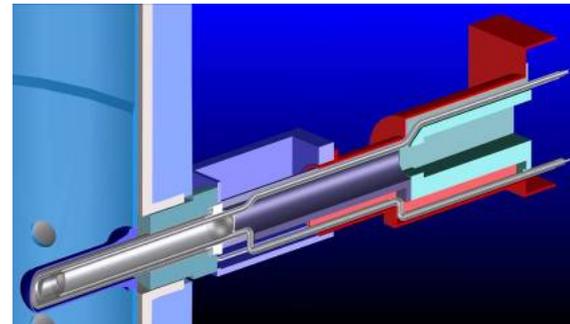
- Developed guide system advanced design
- Completed analysis of guide performance
- Awarded guide contract

## Cold source:

- Completed design & analysis
- Completed regulatory review
- Built and tested scaled mock-up

## Control Room Upgrade:

- Signed MOU with Brookhaven Natl Lab
- Completed conceptual design studies



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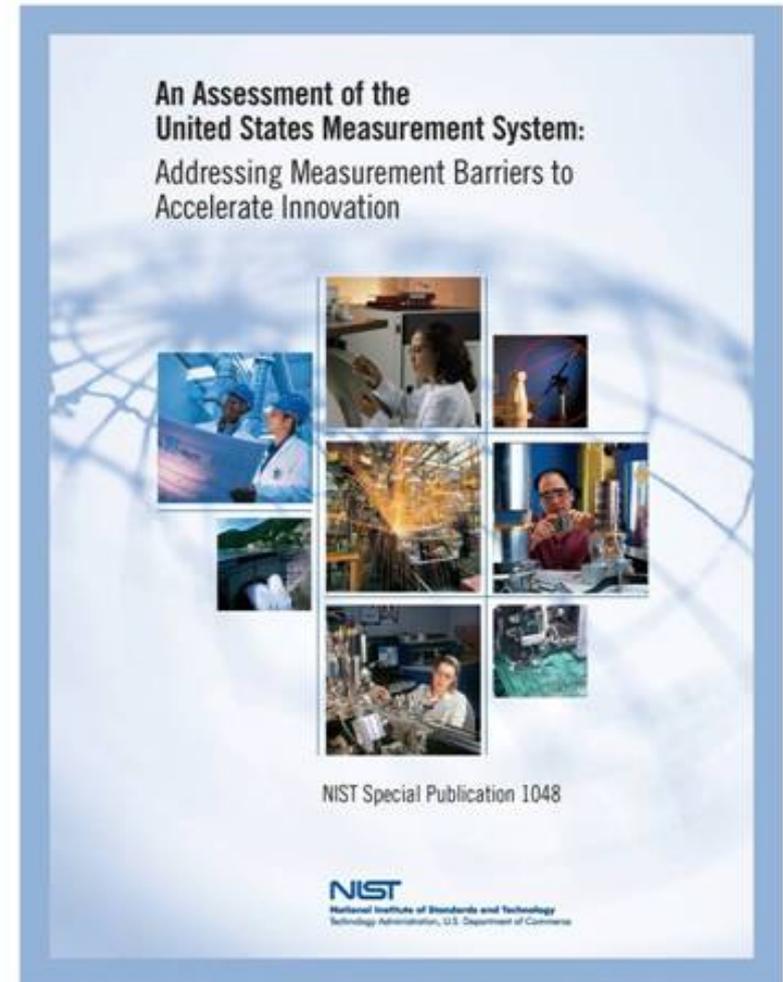
# Assessing Industry's Needs



USMS Director  
Clare Allocca

## USMS Accomplishments

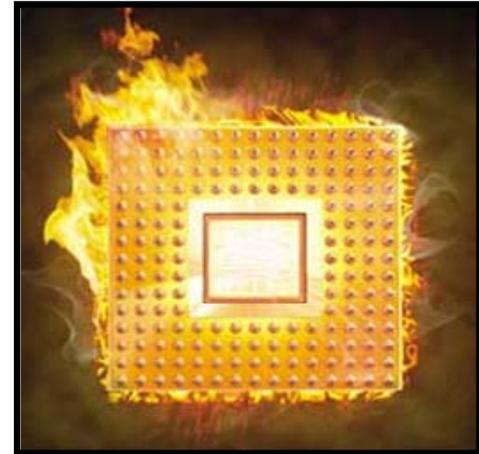
- **Organizational (Awareness and Infrastructure)**
  - Strategic plan aligned with NIST's mission
  - Staffing to address key priorities
  - Website transformation and database design
  - Advisory Council formation
- **Assessment Methodologies Development**
  - Roadmap analyses
  - Economic indicators
  - Measurement need tags analysis
- **Concentration Areas Identification**
  - Nanotechnology/Environmental Health & Safety
  - Under consideration: biosciences, renewable energy
  - Other areas?



# New Partnership Approaches

## NIST/SRC Partner to Advance Basic Research in Post-CMOS Nanoelectronics

- NIST and SRC announced a public-private partnership to support research and innovation in nanoelectronics.
- Through the partnership, NIST and the semiconductor industry will provide funding for research at Universities in the area of nanoelectronics to develop the next logic switch beyond CMOS.
- This partnership is part of a NIST-wide effort to explore new models of public-private partnerships for R&D investment to accelerate and promote innovation.



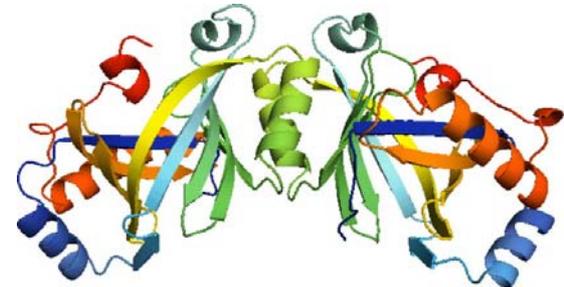
Within 10-15 years the semiconductor industry will approach the limits of existing complementary metal oxide semiconductor (CMOS) technology, as atomic-scale barriers limit the density of components that can be placed on a single chip.

# University of Maryland Biotechnology Institute (UMBI)

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## New MOU signed in August 2007

- Partnership expanded to provide:
  - Interdisciplinary collaboration between NIST's measurement science and UMBI's resources
  - Increased exchange of staff through temporary appointments
  - Training future students with unique expertise from both institutions



**NIST and UMBI are jointly sponsoring  
International Symposium in October 2008:  
“Measurement and Standards Barriers to  
Innovation in the Biosciences”**

# 2007 Malcolm Baldrige National Quality Award Recipients

## The City of Coral Springs

Operates as a city government following a corporate management model, serving Florida's 13<sup>th</sup> largest city (nonprofit)



## PRO-TEC Coating Company

Provides world-class, hot-dipped galvanized coated sheet steel primarily for automotive market (small business)



## U.S. Army Armament Research, Development and Engineering Center

Serves as the armament R&D center for the U.S. Army Special Operations Command (nonprofit)



## Sharp HealthCare

Provides full continuum of care through an integrated health care delivery system in San Diego, CA (health care)

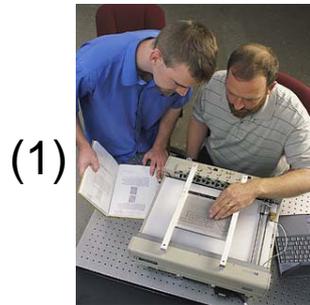


## Mercy Health System

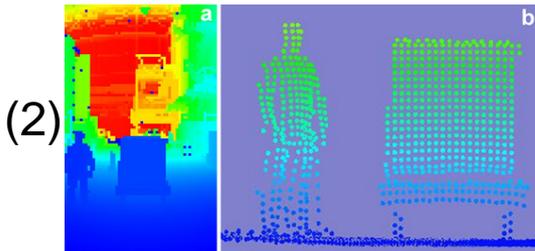
Provides health care and insurance services to residents of southern Wisconsin and northeastern Illinois (health care)



# Technology Transfer Highlights – Collaboration with Industry



License



CRADA



Quality Assurance  
Testing



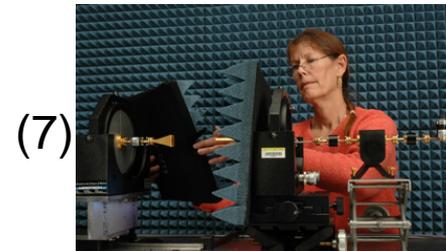
Standard Adopted  
by Industry



Recommendations  
for Standard



Guidelines for Best  
Practices



Measurement  
Service

1. Tactile graphic display device and fingertip graphic reader helps the blind and visually impaired
2. Advanced sensor processing allows robot forklifts to maneuver warehouse pallets
3. Radiation science used to create newer effective vaccine against malaria
4. New scoring system calculates vulnerabilities in credit card transactions
5. NIST WTC Recommendations spur new model building codes
6. Fans clear high-rise stairwells of smoke and toxic gases increases survivability
7. Antenna calibrations extended to accommodate advanced communication radar systems

# NIST – MIT Enterprise Forum Technology Transfer Showcase

- First NIST Technology Transfer Showcase
- In partnership with DC/Baltimore chapter of the MIT Enterprise Forum
- Highlighted NIST's Microfluidics patent portfolio
- 100 attendees included venture capital, angel investors, entrepreneurs and business people
- Next NIST Technology Transfer Showcase to be held April 2008 in partnership with Maryland Technology Development Corporation (TEDCO)



# International Engagement Strategy

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- Four major objectives established for NIST:
  - Measurement and standards infrastructure that enables global market access for U.S. products
  - Global leadership in measurement science as a foundation for emerging technologies
  - Harmonized standards and transparent regulatory regimes
  - Support for U.S. foreign policy objectives
- Three tier approach adopted (global, regional, and bilateral)
- China and Central/South America identified as highest priorities
- International Activities Committee (IAC) established
- IAC establishing criteria for technical assistance, approach to develop industry roadmaps for int'l standards, cooperation strategies with other National Metrology Institutes, and on an interactive website for information sharing etc.

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- Update VCAT Role
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- **Evaluation of NIST Programs**
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# Evaluation: Economic Study Impacts

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## U.S. biopharmaceutical industry\*

- Spends per year \$21 billion on R&D and \$1.2 billion on technology infrastructure to support R&D
- Only ~1/10,000 attain FDA approval
- Takes 8-15 years from discovery to approval
- 8% of all drugs are commercialized
- Finding: improved technology infrastructure through investment in reference materials and data that enable innovation, measurement and test methods, as well as improving interface among equipment, allowing for the accurate transmission of data, and developing techniques that control process quality and accuracy of instrumentation could lead to impact productivity:
  - Increase FDA approval rate from 30% to 40%
  - Reduce new drug expenditures between 25% and 48%
  - Reduce time from discovery to approval from 11 to 8 years

\* *Manufacturing & Technology News, November 30, 2007*

# Evaluation: Economic Study Impacts

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## U.S. semiconductor industry\*

- National Technology Roadmap for Semiconductors (NTRS) in 1992 emphasized the need to develop measurement technologies and standards that could leverage the entire U.S. semiconductor industry
- Subsequent investments by industry and NIST led to steady advances in measurement capabilities
- Cost savings benefits include:
  - Better product design tools to prevent hardware errors
  - Better software standards between design and production
  - Better calibration and quality assurance techniques
  - New ex situ products allowing more robust measurements
  - New in situ products allowing real-time analysis
- Economic benefits from measurement (1996 – 2011, 1996 dollars):
  - Total economic benefits – \$51.3 billion
  - Net present value – \$17 billion
  - Benefit-cost ratio – 3.3;
  - Internal rate of return – 67%.

**\* *Economic Impact of Measurement  
in the Semiconductor Industry, December, 2007***

## Evaluation: NRC FY 2007 Assessment Reports – Quotes

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- *NIST Center for Neutron Research: "There is a substantial and well-satisfied external user community. The in-house science and technology is robust."*
- *Chemical Science and Technology Laboratory: "These measurement capabilities are foundational to U.S. competitiveness, especially in new and emerging technologies. The large number of publications, committee leaderships, and visiting U.S. and foreign scientists and postdoctoral fellows testifies to [CSTL's] technical reputation and leadership position in measurement science."*
- *Electronics and Electrical Engineering Laboratory: "This combination of innovation and technical achievement promises to serve well the emerging technologies of the future."*
- *Information Technology Laboratory: "The work at ITL generally ranks at or near the top of the work being done by peer institutions."*

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## FY2008 Budget Status (\$M)

	STRS (labs)	CRF (facilities)	ITS		TOTAL
			ATP	MEP	
FY2007 Enacted	434.4	58.7	79	104.7	676.8
FY2008 Request	500.5	93.9	0	46.3	640.7

- House and Senate met for Conference, results not public yet
- Indications that the marks are different from the original House and Senate marks
- 3 Scenarios for 2008 budget:
  - Pass remaining Appropriation Bills – unlikely due to presidential veto threat
  - Create an Omnibus of remaining Bills – trying to work compromises with Administration on budget request levels
  - Full year Continuing Resolution (CR) at same level as FY 2007

# NIST Vision 2017

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## Described in previous VCAT meeting:

**What?** - Vision and implementation strategy for NIST in 2017

**Why?** - Need rational plan for growth under the ACI and sustaining thereafter

**Who?** - OU Directors and Chief Officers

**When?** - Draft report being reviewed

## Status:

- Previously developed 8 agreed-upon “component vision statements”
  - Partnering, S&T Policy, Facilities, World-Leading NMI, High-Performing Leadership System, High-Performing Staff, Leading-Edge Research and Services, Tech Transfer
- Actions underway
  - Prioritizing actions proposed in 2017 report
- Progress since the last VCAT meeting
  - Developed characteristics, gaps, objectives, plans
  - Draft report including 5 cross-cutting objectives

# NIST Vision 2017

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## Five cross-cutting objectives:

- NIST develops a robust, systematic **strategic planning process** that addresses and sets agency-wide goals for our research agenda, collaboration and partnership agenda, measurement needs, policy roles, facilities, and staffing. Each NIST operating unit takes actions based on these strategic plans, and measures and analyzes **organizational performance**.
- NIST builds and maintains **world-class facilities and laboratories** for research, measurement, collaboration, training of partners, and conferences.
- NIST develops effective, systematic **communications** with staff, with stakeholders and with the public. NIST effectively transfers its knowledge and technology.
- NIST invests in our **people**. NIST attracts, retains, and develops “the best and the brightest” staff and leaders. NIST leaders think strategically.
- NIST builds effective **collaborations** and works purposefully with others nationally and internationally, developing **strategic partnerships** where appropriate.

# Three-Year Plan

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**The Three-Year Plan reflects both the long term vision outlined in NIST 2017, and the NIST R&D Priorities as outlined in the Director's FY2010 Initiatives Memo:**

## **Strategic Goals:**

- 1. Help the U.S. to drive and take advantage of the increased pace of technological change;*
- 2. Foster more efficient transactions in the domestic and global marketplace;*
- 3. Address critical national needs; and*
- 4. Enhance the effectiveness and efficiency of NIST staff and equipment.*

## **Focus Areas:**

Initiatives that strengthen current core competencies (Strategic Goals 1 and 2)

Research that addresses the most strategic and rapidly developing technology areas (Strategic Goals 1 and 2)

Investment that expands the frontiers of measurement science (Strategic Goals 1 and 4)

Research that addresses critical national needs (Strategic Goal 3)

## **Partnership "Toolkit":**

Grants and Contracts for Strategic Planning and Roadmapping

NIST Technology Fellowships

Measurement Science Research Grants