VCAT Agenda

Tuesday, August 14

- Welcome
- **NIST Update**
- Information Technology at NIST: Present and Future
- Update on Bioscience/Health Program and Planning Activities
- Laboratory Tours
  - Using the Virtual World to Enable Spatially Separated Researchers to Perform Real-Time Cooperative Analyses
  - Quantum Computing with Trapped Ions
  - Standards for Biomagnetic Imaging
- VCAT Subcommittees
  - Update on Nanotechnology
  - Update on Biosciences/Health Care
- Break-Out Sessions (Information Technology and Biosciences/Health)

Wednesday, August 15

- Roundtable Discussion : Subcommittee Reports

NIST Update

William Jeffrey
Director
August 2007

You Are Here !

NIST
National Institute of Standards and Technology
U.S. Department of Commerce

Staff Recognition

Debbie Jin
American Academy of Arts and Sciences Fellow and Lifetime Achievement Award in Science for Bonfils-Stanton Foundation

Mark Kedzierski
American Society of Mechanical Engineers Fellow

Ron Boisvert
Distinguished Scientist of Association for Computing Machinery

Emanuel Knill
Fellow of the American Physical Society

More Staff Recognition

Leo Hollberg
2007 I.I. Rabi Prize

James Bergquist
2007 Herbert P. Broida Prize

Fernando Podio
2006 ANSI Meritorious Service Award

Ray Radebaugh
Honorary Lifetime Membership Award Cryogenic Society of America

2007 ARTHUR S. FLEMMING AWARDS
RECOGNIZING OUTSTANDING FEDERAL GOVERNMENT SERVICE

James Porto
For the development of a neutral atom quantum computer by using optical lattice of double wells as a testbed for elementary quantum logic operations.

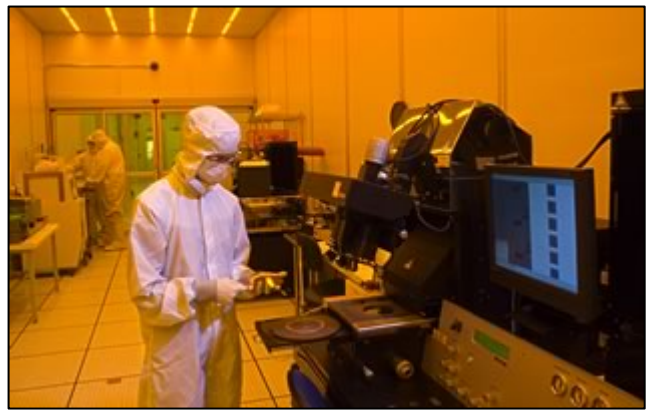
Kent Irwin
His work on SQUID multiplexers used in large-format arrays of superconducting transition-edge sensors that have impacted such fields as particle physics, astronomy, materials analysis, cosmology, and nuclear physics.

David Jacobson
For the development of new and improved imaging instrument, scientists now can conduct detailed surveillance on the comings and goings of water inside hydrogen fuel cells.

Technical Highlights … *Critical National Assets*

NIST Center for Nanoscale Science and Technology (CNST)

- Officially opened May 2007 -- CNST is now accepting proposals.
- The center focuses on developing measurement methods, standards and technology that help emerging nanotechnologies move from the laboratory to production.
- It offers researchers from universities, industry and other government agencies access to state-of-the-art facilities and beyond-state-of-the-art instruments.

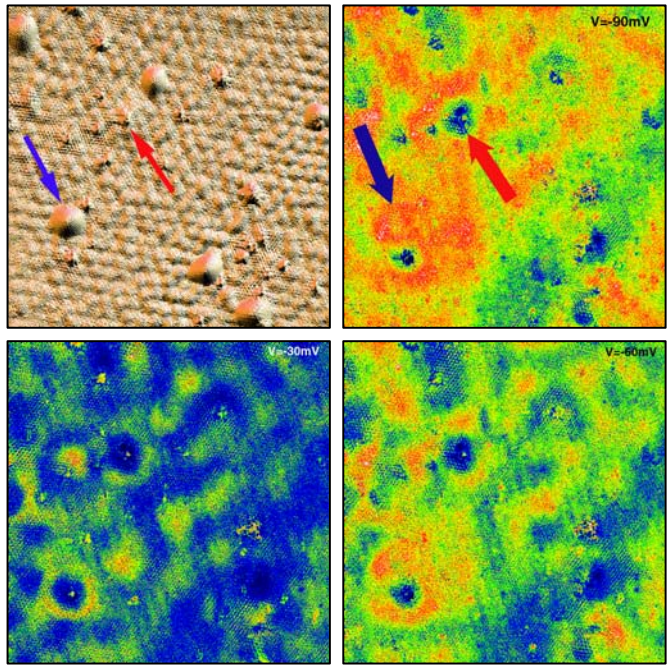


CNST's Nanofabrication Facility features about 930 square meters (10,000 square feet) of class 100 (ISO 5) clean room space for photolithography and other nanoscale fabrication tasks.

Technical Highlights … *Rapidly Developing Technologies*

Speed Bumps Less Important Than Potholes for Graphene

- NIST & Georgia Tech created detailed maps of electron interference patterns in graphene to understand how defects affect current flow.
- Defects in the graphene crystal can cause the electrons to bounce back or scatter -- the key issue is what sort of defects cause scattering, and how much?
- The results are counter-intuitive. Irregularities have minor effect on the electron's passage. In contrast, missing carbon atoms in the lattice cause strong scattering -- the interference patterns rippling around them like waves hitting the piles of a pier.

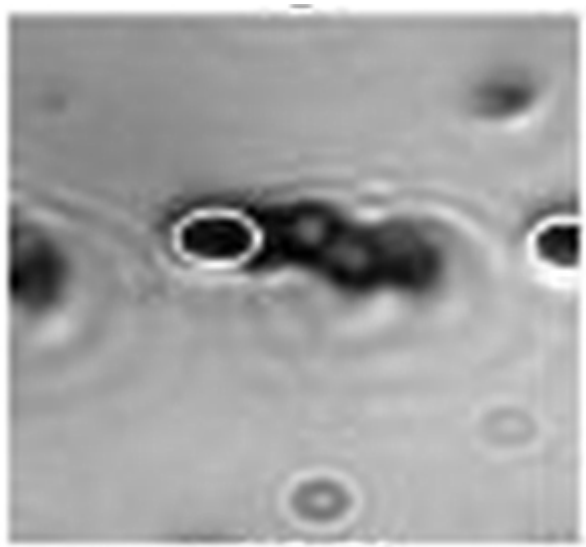


Comparison of an STM topographic image of a section of graphene sheet (top left) with spectroscopy images of electron interference at three different energies shows strong interference patterns generated by atomic scale defects in the graphene crystal (red arrows) but only modest disturbances caused by larger scale bumps in the sheet (blue arrows.) Analysis of the ripples shows that the electron energy in graphene is inversely proportional to its wavelength, just like light waves. The area imaged is approximately 40 nanometers square.

Technical Highlights … *Rapidly Developing Technologies*

Magnetic Computer Sensors May Help Study Biomolecules

- NIST researchers found that arrays of switches called “spin valves” -- commonly used as magnetic sensors in the read heads of high-density disk drives -- also show promise as tools for controlled trapping of single biomolecules.
- The arrays might be used in chip-scale, low-power microfluidic devices for capturing and manipulating large numbers of individual biomolecules for massively parallel medical and forensic studies -- a sort of magnetic random access memory (MRAM) for biosciences.



This micrograph shows a strand of magnetic particles trapped by a 'spin valve' (highlighted in white) and rotated by the application of an external rotating magnetic field. NIST is studying the possible use of spin valves arrays for parallel processing of biological molecules.

Technical Highlights … *Responding to National Needs*

NIST Begins Technical Study of S.C. Warehouse Fire

- NIST began a technical study of the Super Sofa Store furniture warehouse fire in Charleston, S.C. that killed nine firefighters.
- Within 36 hours of the fire, NIST had a reconnaissance team of experts on site to gather data about the fire as well as the subsequent collapse of the building.
- The NIST team of fire experts has also participated in interviews of the Charleston Fire Department personnel. The NIST team will use the interview data to establish a timeline for reconstructing the fire in a computer simulation.

Nine firefighters were killed when the blazing furniture-store building collapsed on them.

Changes: New Operating Units (now “Official”)

NCNR

National resource for neutron- based measurements

- “See” structure at the nanoscale
- Uniquely sensitive to hydrogen
- Probe magnetic structure
- Non-destructive probe

Chemistry:
Properties of cement

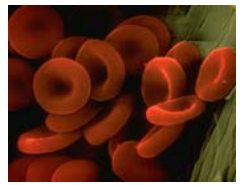
Magnetic data storage

Fuel cells & hydrogen storage materials

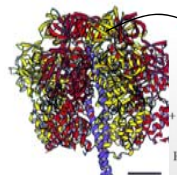
CNST

Ant
~ 5 mm

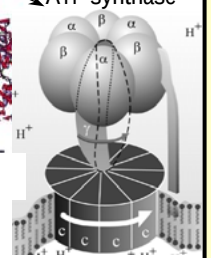
Dust mite
200 μm



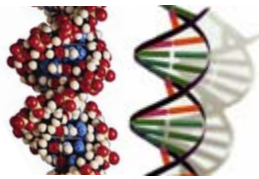
Red blood cells
(~7-8 μm)



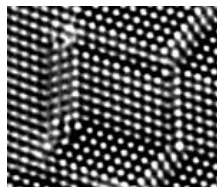
ATP synthase



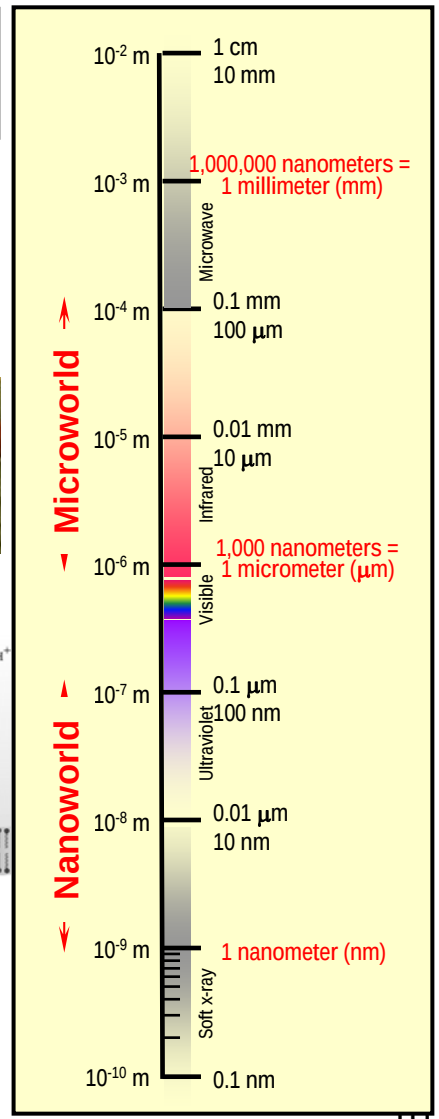
~10 nm diameter



DNA
~2-1/2 nm diameter

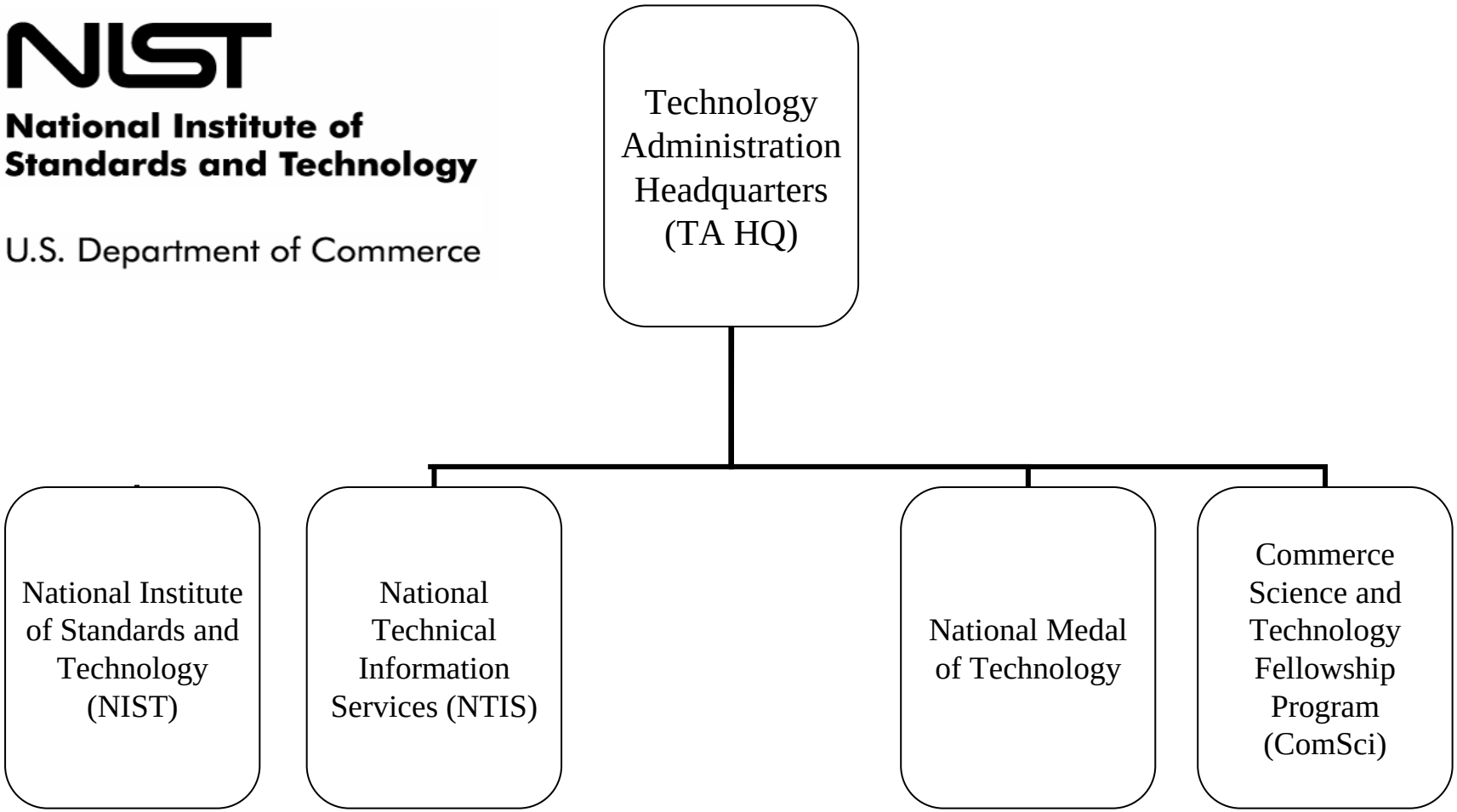


Atoms of silicon
spacing ~tenths of nm



Department of Commerce Changes

NIST
National Institute of Standards and Technology
U.S. Department of Commerce



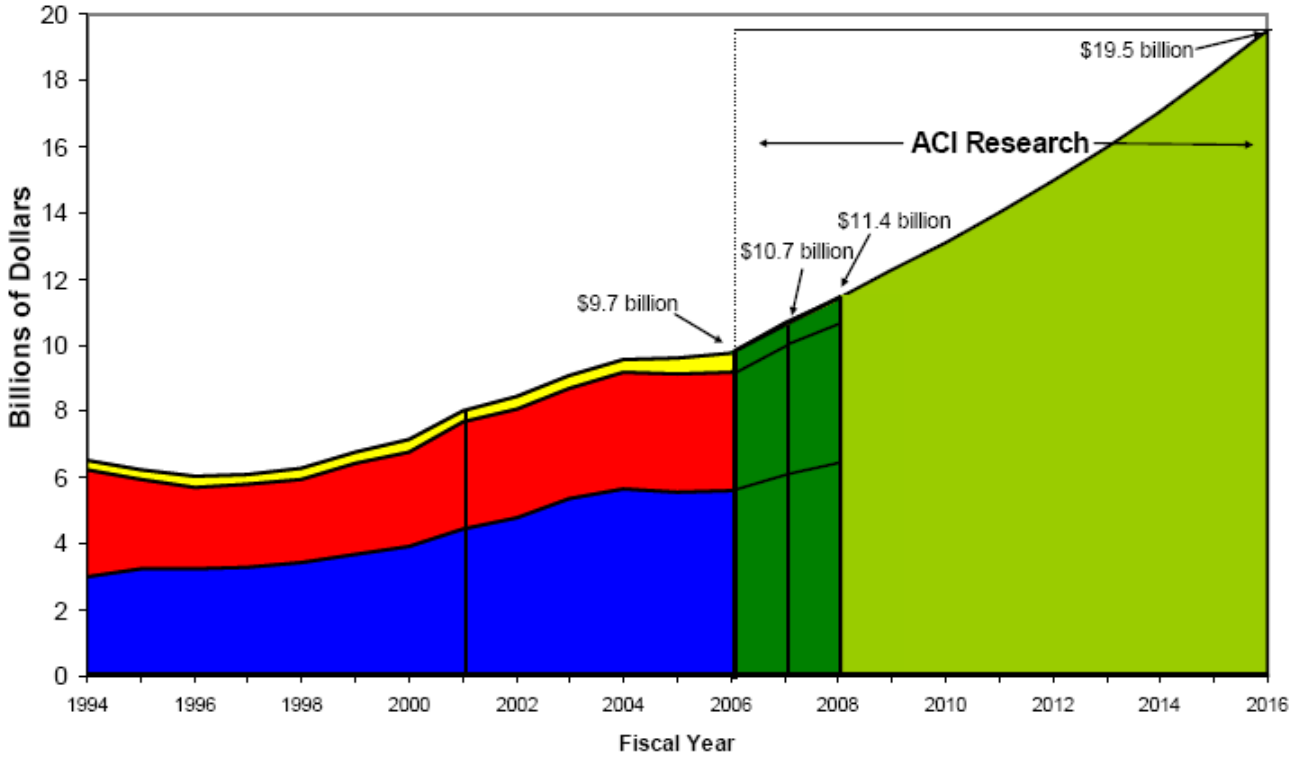
Reauthorization Language ("COMPETES" Bill)

Last Appropriations Reauthorization was in 1992
Changes:

- Establishes Authorization Levels for FY2008-FY2010
- Abolishes Advanced Technology Program (ATP)
- Creates Technology Innovation Program (TIP)
  - *"address critical national needs through transforming the Nation's capacity to deal with major societal challenges that are not currently being addressed."*
- Increases Allowed Number of Fellowships and Post-Docs
- Eliminates Technology Administration
- Number of Technical Amendments

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



FY2008 Budget Status ($M)

	FY2007 Enacted	FY2008 Request	House Mark	Senate Committee Mark
STRS (labs)	434.4	500.5	500.5	502.1
CRF (facilities)	58.7	93.9	128.8*	150.9*
ITS				
ATP	79	0	93	100
MEP	104.7	46.3	108.7	110
TOTAL	**676.8**	**640.7**	**831.0**	**863.0**

* Includes Directed Grants

Request is a 20.5% increase to the NIST "Core" (labs + facilities)

NIST Vision 2017

What?

- **Vision for NIST in 2017 and an implementation strategy for achieving it**

Why?

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

Who?

- **OU Directors and Chief Officers**

When?

- **Draft Report late fall / early winter 2007**

Status:

- **Have 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
- **Have commissioned 8 vision teams of 4-5 OU Directors and Chief Officers per team**
  - Teams are developing characteristics, gaps, objectives, plans

Future:

- **Synthesize results of 8 vision teams into a unified vision and implementation strategy for NIST in 2017**

International Activities Strategy

Four major goals established for NIST:

1. Measurement and standards infrastructure that enables global market access for U.S. products
2. Global leadership in measurement science as a foundation for emerging technologies
3. Harmonized standards and transparent regulatory regimes
4. 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 NMIs, and on an interactive website for information sharing etc.

FY2010 Initiatives – NIST Priorities 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

Evaluation Criteria (1 of 2)

Corresponding Heilmeier Questions	Evaluation Criteria	Scores					Weight	Total
Why should NIST do this?	**Relevance:** *Is the project relevant to NIST's mission and aligned with Laboratory or NIST strategic directions? Is NIST the appropriate organization to do this work?*	**NO**			**YES**		**N/A**	**N/A**
		Low 1	2	3	4	High 5		
What is the problem and why is it hard? *How is it solved today, and by whom?*	**Background:** o *Does the proposal show an understanding of the problem described?* o *Was it developed with broad stakeholder input? If so who?* o *Does the initiative clearly link to the goals of the ACI?* o *Does the proposal articulate to what extent the initiative will impact the identified problem?*						1	
What is the new idea? *Why can we succeed now?* *Technical Plan*	**Technical merit:** *Does the proposal demonstrate scientific and technical excellence? Does it present a new idea that could lead to success?*						2	
	Project teams: o *Do the members of the project team have qualifications and accomplishments that indicate their ability to accomplish the project?* o *If the focus of the initiative is broader than the expertise resident within an individual OU does the project team contain membership from multiple OUs?*						1	
	Project Management: o *Does the proposal clearly articulate the team structure and decision making process?*						1	

Evaluation Criteria (2 of 2)

	○ *Does the proposal clearly articulate how interactions between project team members will occur throughout the project's lifetime?*							
	Technical plan: ○ *Does the proposal articulate how funds will be distributed across the project team over the life of the project?* ○ *Does the proposal describe how progress will be measured?* ○ *Is there a clear technical plan with well-defined goals, milestones and deliverables?*						1	
What is the impact if successful, and who would care?	**Knowledge Transfer:** ○ *Does the proposal clearly articulate how the knowledge and results from the proposed initiative will be successfully disseminated to identified stakeholders?* ○ *Partnerships* ○ *Personnel exchanges* ○ *Grants* ○ *Products and services* ○ *Strategic planning and roadmapping*						1.5	
	Impact ○ *Is the potential payoff for NIST, our customers, and the nation substantial?* ○ *How will the initiative's impact be measured?* ○ *If the project is successful, who would care?*						3	
	Overall rating of the proposal							

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