2004 Annual Report

The NIST Visiting Committee on Advanced Technology

U.S. Department of Commerce
Technology Administration
National Institute of
Standards and Technology
January 2005

Report prepared by:
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Preface

The Visiting Committee on Advanced Technology (VCAT) of the National Institute of Standards and Technology (NIST) was established in its present form by the Omnibus Trade and Competitiveness Act of 1988. The VCAT reviews and makes recommendations regarding general policy for the National Institute of Standards and Technology, its organization, its budget, and its programs within the framework of applicable national policies as set forth by the President and the Congress. It submits an annual report to the Secretary of Commerce for submission to the Congress. This Fiscal Year 2004 annual report covers the December 2003 meeting through the September 2004 meeting.

The Committee reviews the Institute's strategic direction, performance, and policies, and provides the Secretary of Commerce, Congress, and other stakeholders with information on the value and relevance of NIST to the U.S. science technology base and the economy. Over the past year, the Committee has been active in shaping NIST's strategic plan, assessing the strengths of its programs and how progress is evaluated, reviewing its strategic operational needs, and serving as a key interface to stakeholders. Throughout the year, the Committee seeks to cover the full portfolio of NIST's programs through direct discussion with NIST leaders, scientists, and engineers, as well as representatives from the National Research Council Board on Assessment of NIST Programs, the Advanced Technology Program (ATP) Advisory Committee, and the Baldrige National Quality Program Board of Overseers. Reactions and observations are discussed candidly with the NIST representatives and other guests involved at each meeting. This feedback is positively received, and the Committee sees much evidence of constructive response to it. At each quarterly meeting, the Committee also visits various NIST laboratories and discusses the research projects directly with the scientific and technical staff. These laboratory tours help the Committee assess NIST's progress towards executing its Strategic Plan.

Members of the Committee are selected from industry and academia solely on the basis of established records of distinguished service and are eminent in research, engineering, business, or other fields relevant to NIST's mission. Appointed by the NIST Director for staggered three-year terms, the members have diverse backgrounds and provide a representative cross-section of traditional and emerging U.S. industries. Four new members joined the Committee during 2004: Dr. Donald Keck, Mr. Edward Noha, Mr. Thomas Saponas, and Dr. James Serum.

This report highlights the Committee's findings and recommendations along with a summary of observations. Detailed meeting minutes and presentation materials are available on the NIST web site at www.nist.gov/director/vcat.

2004 Visiting Committee Members

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VCAT Chair
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Term expires Jan. 2006

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Senior Vice President
GE Corporate Research & Development
General Electric Company
Term expires Jan. 2006

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Bluefire Partners, Inc.
Term expires Jan. 2008

DR. RICHARD M. GROSS
Retired Corporate Vice President of Research and Development
The Dow Chemical Company
Resigned July 2004

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VCAT Vice Chair
Corporate Director, Safety & Health
DuPont
Term expires Jan. 2007

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Vice President
Track-Type Tractors Division
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Term expires Jan. 2006

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Principal Findings and Recommendations

The VCAT commends NIST for its well-managed and high quality portfolio of programs that is vital to strengthening the nation's innovation, trade, public safety, security, and jobs. These programs consist of the NIST Laboratories, the Advanced Technology Program, the Manufacturing Extension Partnership, and the Baldrige National Quality Program, with each playing a distinctive role in the nation's technology infrastructure. Consistent with the Administration's report on "Science for the 21st Century," NIST's activities are vital to ensuring the nation's economic growth and in setting the stage for innovation and technology. The Committee strongly believes that NIST's measurement research, standards, and services provide the nation's underlying scientific and technical infrastructure that supports technology-based programs in industry, universities, and other government agencies.

However, long-term funding constraints are threatening NIST's future capabilities to respond to the scientific and technical needs for emerging technologies such as biotechnology, nanotechnology, and information technology. To help alleviate this funding issue, the VCAT and NIST have been conducting extensive outreach over the past year to inform key stakeholders about the value of NIST and its unique role in measurements and standards.

The VCAT has been providing guidance to NIST on its Strategic Plan, including evaluation methods, and is quite impressed with the Institute's development and implementation of the Plan and its commitment for further improvements. The VCAT believes that NIST's visibility must be dramatically increased to facilitate an increased budget and to attract strategic partnerships that are commensurate with NIST's world-class technical expertise and highly specialized facilities and equipment aimed at improving our nation's scientific and technology infrastructure. The future competitiveness of U.S. industries will be threatened if budget limitations continue to prevent NIST from addressing the measurement and standards challenges related to the new technologies of the 21st century.

The VCAT is pleased to have had the opportunity to meet twice with Deputy Secretary Kassinger during FY 2004 to discuss the value of NIST and to express concerns about its budget. The Committee is particularly appreciative of Deputy Secretary Kassinger's suggestions for ways to help demonstrate the value of NIST to its stakeholders and for his interest in this area. The VCAT is encouraged by the Department of Commerce support for NIST and its budget, and is looking forward to engaging in a productive relationship with the new Secretary of Commerce.

BUDGET

Findings** — **Minimal growth in NIST's R&D budget has constrained the Institute's ability to meet the nation's measurement and standards needs. Without greater capacity, important measurement needs will not be addressed.

Recommendations:

NIST Laboratories

- NIST's budget for the laboratories must be increased immediately to fund the Institute's strategic initiatives and to compensate for unfunded Congressionally-mandated programs, inadequate adjustments-to-base, and unfunded salary increases that have gradually eroded the amount of funding available for research in core metrology programs.

- For the longer term, the VCAT advocates that NIST's budget for the laboratories continue to increase significantly in order to implement strategic programs that are required to sustain the nation's research infrastructure. While NIST is successfully addressing a wide range of immediate measurement and standards needs, the organization also must continue to invest in developing core competencies that will be required to provide the measurement and standards capabilities for the future.

Facilities

- NIST must receive the requested budget increases to equip the nation's state-of-the-art Advanced Measurement Laboratory (AML), to improve the NIST Center for Neutron Research (NCNR), to

modernize the NIST Boulder Laboratories, and for maintenance and repairs associated with the deterioration and obsolescence of NIST's aging facilities. Without these investments, NIST's ability to respond to the nation's measurement and standards needs will be severely jeopardized, including the delivery of time and frequency standards.

Manufacturing Extension Partnership

- Funding for the Manufacturing Extension Partnership (MEP) needs to be stabilized to help ensure that the existing network of small and medium-sized manufacturers remain competitive as a result of MEP's technical assistance. Significant performance results for many of MEP's clients ranging from increased sales to increased jobs are a testimony to the value of this program to the nation.

Advanced Technology Program

- The budget for the Advanced Technology Program (ATP) needs to be stabilized to continue co-funding R&D partnerships with the private sector that accelerate and develop innovative technologies for broad national benefit in areas of inadequate levels of private investment.

OUTREACH

Findings — NIST lacks visibility and recognition commensurate with its program strengths and impacts.

Recommendations:

- Although outreach activities are increasing, NIST should develop a longer-term comprehensive plan for marketing its capabilities to key customers and stakeholders.

- To complement these efforts, the VCAT members will continue to advise NIST's stakeholders on the strategic direction and value of NIST's programs.

STRATEGIC DIRECTION AND PERFORMANCE

Findings — NIST has a well-crafted Strategic Plan that is being implemented NIST-wide and reflects senior management's commitment to continuous improvement and direction of resources to highest opportunities.

Recommendations:

- To further improve the Strategic Plan, NIST should develop more specific short-term and long-term metrics and other quantitative data, consistent with the Baldrige framework, that will aid in performance evaluation. This information also should be reflected in the 2005 Balanced Scorecard, which will be used by senior management to define and evaluate NIST-wide performance goals and metrics throughout all levels of the Institute.

- NIST should further expand its efforts in the Strategic Focus Areas (SFAs) to help the United States become competitive in these rapidly growing fields. In particular, the VCAT urges NIST to more closely examine the Institute's role in biosciences and the pharmaceutical industries, where a wide-range of measurements and standards are needed.

- With possible budget constraints in the future, it is even more important for NIST to continue exploring opportunities for extensive collaborations and partnerships to take advantage of expertise outside of the Institute. NIST should update the Strategic Plan to include strategies for identifying where partnerships should be appropriate, targeting specific partnership organizations, and achieving these partnerships.

- The analysis of NIST's role in the National Measurement System should be integrated into the next version of the Strategic Plan.

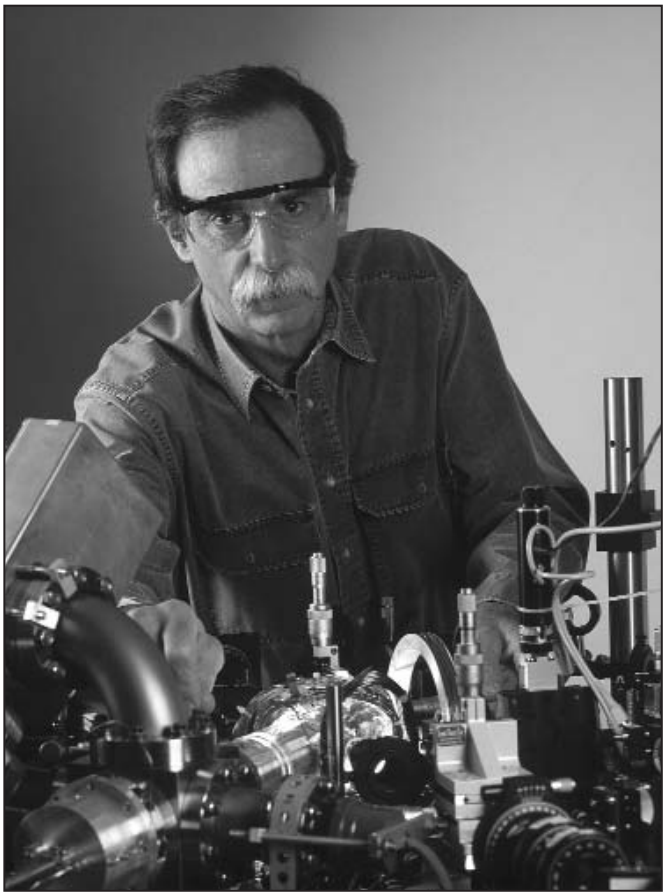
ORGANIZATIONAL EXCELLENCE

Findings — NIST's world-class talent, continued pursuit of organizational excellence, and highly specialized facilities and equipment are hallmarks of a high-performing agency. NIST's programs demonstrate technical excellence, resulting in outstanding achievements and numerous awards. NIST's world leadership capability is providing critical technical infrastructure for emerging technologies and homeland security.

Recommendations:

- NIST must continue to upgrade its aging buildings and facilities or seriously risk undermining its state-of-the-art capabilities in the near future.

- To further improve the Institute's safety management practices and results, NIST's Safety Council should benchmark safety practices with other organizations and seek additional advice from VCAT members with expertise in this field.



NIST physicist David Wineland in the laboratory where he worked with colleagues to demonstrate "teleportation" by transferring key properties of one beryllium ion to another atom without using any physical link.

Summary of Observations

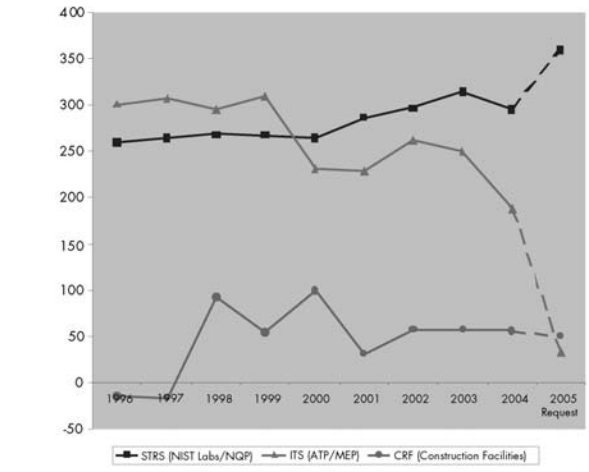
BUDGET

NIST Laboratories

NIST's budget outlook continues to be of great concern to the Committee. The reduced FY 2004 appropriation adversely affected the staff as a number of employees left NIST due to reduction-in-force actions, early retirements, and buy-outs. The NIST laboratories have shown only modest growth over the last decade after adjusting for inflation as illustrated in Figure 1.

In fact, while not reflected in Figure 1, the amount of funding available for core metrology programs in the NIST laboratories has been eroding during this same timeframe as the Institute has had to compensate for huge new responsibilities in response to a series of unfunded Congressionally-mandated programs, inadequate adjustments-to-base, and unfunded salary increases. When adjusted for these costs, the funds available for research in the NIST laboratories only grew 3 percent since 1997, compared to other Science and Technology agencies that grew 48 percent in the same timeframe.

Figure 1. NIST Appropriations
Constant FY 1996 Dollars (millions)



Source: NIST Acting Director presentation to the VCAT, Sept.14, 2004.

The President's FY 2005 budget request for increased funding for the NIST laboratories is very encouraging but more significant increases are required in the long-term to support NIST's strategic initiatives and the development of core competencies needed to address the nation's future measurement and standards challenges. The FY 2005 budget initiatives for the laboratories support the NIST 2010 Strategic Plan as described under the "Summary of Operations, Strategic Direction and Performance" section of this report (page 7).

The lead agency issue continues to jeopardize NIST's appropriations. NIST's reliance on direct funding from other agencies to implement its Strategic Plan and to remain solvent is problematic. Other agencies typically fund short-term specific projects at NIST that require immediate results rather than long-term, new measurement capabilities needed for the future. Also, many of NIST's program initiatives for its measurement and standards work have been jeopardized throughout all stages of the budget cycle as the Institute is encouraged to seek direct funding instead from the "lead agency" responsible for the particular national priority, such as the National Institutes of Health (NIH) for biotechnology research or the Department of Homeland Security (DHS) for homeland security. This misconception must be corrected as NIST is the lead agency for measurements and standards. While the other agency missions focus on application areas such as biosystems and health, homeland security, and energy, all depend on the underpinning measurements and standards that require NIST's unique expertise and capabilities. The diverse competencies needed to provide these measurements and standards require continued direct funding support.

Facilities

NIST's facilities continue to require additional funding to help shape NIST's capabilities and productivity well into the 21st century. Based on NIST's three-phase 1998 Facilities Improvement Plan, Congress fully funded construction for the AML and partially funded renovations in existing research facilities through FY 2004. However, significant additional investments are needed to overcome remaining problems associated with deterio-

rated and obsolete laboratory facilities. Without a fully-equipped AML and upgraded facilities and laboratories, including the NCNR, NIST's ability to respond to the nation's measurement and standards needs will be significantly degraded.

The recently completed AML, the world's most sophisticated measurement and standards laboratory, now requires additional funding for special instrumentation and equipment needs to take full advantage of its unique capabilities and to attract strategic partners. The President's FY 2005 budget request for the laboratories includes an increase of $25.5 million for this critical investment. With a fully-equipped AML, NIST's capacity will have increased substantially and NIST will have a laboratory capacity commensurate with its world-class scientific expertise and programs. However, increased utility and operation and maintenance costs associated with the AML are a serious concern and must be addressed in future budgets. NIST estimates that these costs will total $9 million in FY 2005 and are expected to increase as the AML becomes fully operational.

The majority of the NIST buildings were constructed in the 1950's and 1960's on the Boulder and Gaithersburg sites, respectively. Many of these structures require significant investments to address their deteriorating conditions and obsolete laboratory facilities, including NIST's physical plant, which is limiting NIST's measurement capabilities. To address these needs, the President's FY 2005 budget request for facilities includes an increase of $25.7 million primarily to modernize the NIST Boulder laboratories and an additional $10.6 million for the annual safety, capacity, maintenance and major repairs (SCMMR) budget for NIST's aging structures. However, even with this increase, the total amount of funding available for SCMMR in FY 2005 would be $33.7 million, which is still below industry's best practice recommendation for an annual maintenance budget of at least 3 percent of the replacement cost of the buildings for a technical organization*. To meet this level, NIST requires a SCMMR budget totaling $52.7 million in FY 2006.

Courtesy HDR Architecture, Inc./Steve Hall © Hedrich Blessing

The NIST Nanofabrication Facility, an ultra clean wing of the Advanced Measurement Laboratory, will be operated as a user facility. It will provide NIST's collaborators with access to expensive nanofabrication tools and specialized expertise in a shared-cost environment.

To improve the capabilities of the NCNR, the nation's premier neutron facility, the President's FY 2005 budget request also includes an increase of $8.3 million. These improvements will benefit the more than 1,900 researchers from university, industry, and government that rely on the NCNR's advanced measurement capabilities as well as help to significantly expand collaborations in materials science, biotechnology, chemistry, engineering, and physics.

Further discussion related to these increases is provided under the "Summary of Observations, Organizational Excellence" section of this report (page 17).

* Hanscomb, Faithful & Gould (HF&G), 2004 – *Facilities Condition Assessment*

MEP and ATP

Long-term funding for the MEP and ATP should be resolved. Prior to FY 2004, MEP's funding had been stable while ATP's funding has fluctuated over the years. As confirmed by a multitude of stakeholders, both of these programs have made significant contributions to U.S. industry and their funding should be continued. The VCAT is encouraged by the emergency funding that Congress secured to enable MEP to operate without disruption for the first few months in FY 2005 in anticipation of a favorable FY 2005 appropriations bill.

Faced with budget uncertainty, the Institute recognizes the importance of educating stakeholders about the value of NIST through increased marketing and outreach efforts and exploring and establishing new strategic partnerships to help leverage NIST's resources and expertise.

OUTREACH

The top priority for the new NIST Chief of Staff is outreach to NIST stakeholders to improve their awareness, appreciation, and support of the Institute and provide more visibility to NIST. An effective marketing and outreach effort will help the Institute better reflect customers' priorities in program planning, leverage NIST's resources through partnerships, facilitate better use of NIST's results, and increase support by educating stakeholders about NIST.

Based on the Committee's outreach to Congress and industry leaders, the VCAT found that many of these key stakeholders were aware of NIST but not familiar with its programs and impacts due to the Institute's relatively small size and specialized functions. To help communicate the value of NIST and its unique role in measurements and standards, the VCAT developed key impact statements about the organization that concisely summarize NIST's contributions (see Appendix A). The VCAT encouraged NIST to develop communication tools to use as part of a more aggressive outreach effort to Congress, industry leaders, and other influential stakeholders in government. The Committee also encouraged NIST to continue to host tours of the NIST laboratories for these stakeholders and to visit other organizations for more effective outreach. To further increase visibility, NIST responded to the Committee's recommendation to develop a brief key message that highlights the value of NIST, including its role in innovation, trade, security, and jobs that aligns with the current mission statement.

Outreach activities have increased over the past year with significant results. Both the NIST leadership and the VCAT members have been involved in numerous outreach activities to make NIST more visible both within the government and with key business groups and industry leaders. For example, NIST hosted several congressional visits to NIST and had key engagements with numerous industry groups, large companies, and academia. There also have been several Congressional hearings on the NIST budget in which members of Congress as well as industry representatives testified on behalf of NIST, including Deborah Grubbe, Corporate Director of Safety and Health at DuPont and Vice Chair of the VCAT. Another major outreach activity was the AML dedication held on June 21, 2004, with more than 200 guests representing a cross-section of NIST's indus-

Table 1. Support for NIST

Examples of statements of support:

- NAM, NACFAM, NTMA, Modernization Forum, U.S. Chamber of Commerce and 57 other organizations
- IEEE
- Industrial Research Institute
- Electronic Industries Association of America
- Information Technology Association of America
- International Code Council
- U.S. Fuel Cell Council
- Semiconductor Industry Association
- National Fire Protection Association
- Zyvex Corp.
- Cogent Systems
- DuPont
- Task Force on the Future of American Innovation
- Alliance for Science and Technology Research in America (ASTRA)

Source: NIST Chief of Staff presentation to the VCAT, June 8, 2004.

trial and scientific partners, other government agencies, state and local officials, and Congress, including Senator Paul Sarbanes, Representative Chris Van Hollen, and John H. Marburger III, director of the White House Office of Science and Technology Policy.

With a broader understanding of NIST's circumstances, many stakeholders and customers have sent letters in support of the NIST budget to Congress that attest to the value of the Institute's programs (see Table 1). For example:

- The Task Force on the Future of American Innovation, comprised of 14 organizations associated with business and academia, specifically identified NIST as one of the key research agencies that should receive an increase of 10 to 12 percent per year over the next five to seven years and pointed out that NIST's budget accounts for less than one-half percent of the government's R&D budget.

- The Alliance for Science and Technology Research in America (ASTRA) formed a coalition to help increase funding for NIST and developed a two-page summary of why America needs NIST.

The Committee is looking forward to reviewing NIST's longer-term comprehensive strategic plan for marketing its capabilities and the associated measures for success as the Institute becomes even more proactive in these efforts.

Table 2. Structure of the Revised NIST 2010 Plan (version 1.b)

Long-term goals	Objectives	Program
Promote innovation, trade, security, and jobs by strengthening the Nation's measurements and standards infrastructure	Advance the state of the art of measurement science	NIST Laboratories
	Assure the availability and efficient transfer of measurements and standards capabilities to manufacturing and service industries, universities, and other R&D-intensive organizations	
	Build capabilities in Strategic Focus Areas for emerging technology-based industries	
Accelerate private investment in and development of high-risk, broad-impact technologies	Encourage industry and academia to increase R&D investments in high-risk, broad-impact technologies.	Advanced Technology Program
	Engage all elements of the national R&D enterprise in the ATP	
Raise the productivity and competitiveness of small manufacturers	Collect and disseminate data and information related to high performance business practices, expand MEP advisory services, and improve the effectiveness of MEP Centers	Manufacturing Extension Partnership Program
	Improve efficiency and effectiveness through system integration and development of a broader and more stable revenue base	
Catalyze and reward quality and performance improvement practices in U.S. businesses and other organizations	Develop and disseminate educational materials designed to help businesses and other organizations initiate and sustain performance improvement strategies	Baldridge National Quality Program
	Lead an expanding national system of state and local quality programs	
Pursue organizational excellence	Increase NIST's impact by focusing on the customer	NIST
	Increase NIST's impact by focusing on our people	
	Leverage information science and technology	

Source: NIST Acting Deputy Director presentation to the VCAT, June 8, 2004.

STRATEGIC DIRECTION AND PERFORMANCE

NIST leadership is committed to improving its strategic planning process. By establishing a process for reviewing and updating the NIST 2010 Strategic Plan, NIST management has shown both their ownership of the Plan as well as a drive to implement it through involving others at NIST. NIST 2010, version 1.b, is a vast improvement over the previous version. The VCAT commends NIST leadership for their willingness to continue to learn how to more effectively develop a strategic plan, their responsiveness to suggestions for improvements, and their recognition that the plan must be continuously improved as a living document. NIST leaders recognize the challenges involved with developing performance metrics for a scientific organization and are continuing to improve the methodology for generating this information.

Evolution of NIST 2010

NIST has been steadily improving its strategic planning process since 2001, when the original NIST 2010 Strategic Plan was developed under the auspices of the NIST Strategy Council. In response to external develop-

ments and input from the VCAT, customers, stakeholders, and staff, the NIST Senior Management Board revised the Plan and produced version 1.b in June 2004 that addressed many of these groups' comments and suggestions. This version provides more balance among NIST's programs as illustrated in Table 2.

Version 1.b also includes a greater focus on NIST's core metrology and measurement service functions, the repositioning of the Homeland Security goal as an SFA, the repositioning of the SFAs as a single objective under the laboratories, the clarification of NIST's distinct roles in the SFAs, and a description of the implementation mechanisms. All of NIST's technical programs now fall within the three objectives of version 1.b of the NIST 2010 Strategic Plan in recognition of their significant contributions to the nation's measurement and standards infrastructure (see Appendix B for illustrative examples of NIST's technical excellence). Consistent with NIST's intent that this Plan remains a working document, the next-generation plan, version 2, will incorporate the VCAT's input on version 1.b, with more focus on impact paths and end results, NIST's central value propositions, and NIST's role in the National Measurement System (NMS). NIST is examining this role in response to new measurement challenges of the 21st century that go beyond the scope of the classical International Systems of Units, the SI. The VCAT agrees that meeting these challenges is vital to our nation's commerce and technology. NIST Standards Services Division Chief Mary Saunders led a task group with representatives from across NIST Operating Units that was commissioned and charged with defining a process for developing a 21st century view of the nation's measurement system and incorporating a dynamic leadership role for NIST. In June 2004, this task group developed a white paper that provides definitions of measurement and the nation's measurement system and identifies an array of potential roles for NIST for discussions with stakeholders and customers. These discussions are intended to help shape NIST's strategic directions and priorities. NIST staff and managers also are actively engaged in this process by providing comments on the approach, identifying external audiences, and helping to solicit answers to the questions posed in the paper. The VCAT appreciated the opportunity to provide positive comments on the proposed approach and to identify customers and stakeholders that should be consulted. The VCAT looks forward to NIST's specification of the key needs and challenges associated with the NMS and NIST's distinctive contributions. The Committee has advised NIST leadership on the importance of integrating the analysis of NIST's role in the NMS into the next version of the Strategic Plan.

Implementation of NIST 2010

NIST is making excellent progress toward implementing the Plan through the use of several mechanisms that will help the Institute build on existing core competencies and expand capacity in the SFAs. These mechanisms focus on: 1) budget initiatives; 2) competence funding; 3) Strategic Working Groups; 4) Operating Unit operational plans; and 5) strategic partnerships.

Table 3. DOC/NIST Budget Initiatives: FY 2003-2004 Request v. Enacted

Programmatic budget initiatives derived from NIST 2010 strategic objectives

		FY 2003 ($M)		FY 2004 ($M)	
		Request	*Enacted*	*Request*	*Enacted*
Build core competencies	Competence for Advanced Measurements	4.7	0		
	Neutron Science	6.0	0		
	Wireless Technologies	2.0	2.1		
	Computer Security Expert Assist Team	1.0	1.0		
	Measurement Science, Standards, and Services			4.5	0.7
Expand Capacity in SFAs	Public Safety and Security	2.0	3.0	10.3	0
	Nano	4.0	1.5	5.2	1.4
	Bio / Health Care	3.0	2.0	1.0	0.4

Source: NIST Acting Director presentation to the VCAT, June 8, 2004.

***Budget Initiatives* —** NIST has been developing programmatic budget initiatives on the basis of NIST 2010 strategic priorities since FY 2003. However, as shown in Table 3, these initiatives have received modest appropriations of $8.6 million in FY 2003 and only $2.5 million in FY 2004 largely due to other priorities in the Administration and Congress, primarily in homeland security.

The Committee is encouraged by the President's FY 2005 budget request that includes significant increases in strategic initiatives for NIST, including $16.2 million to build core competencies in measurement science, standards, and services; $15.6 million for advances in manufacturing; and $18.6 million for public safety and security.

***Competence Funding* —** The NIST-wide competence fund is successfully used to support projects that will strengthen NIST's traditional measurement and standards mission, and/or advance the Institute's SFAs. Eight such competence projects have been funded since FY 2002 and seven more projects will begin in FY 2005 as shown in Table 4.

All FY 2005 proposals selected for funding emphasized how they will help NIST meet future national metrology needs. Most of these projects are collaborative efforts between Operating Units. Beginning in FY 2005, each of the SFAs and two core measurement and standards areas will be partially supported with competence funding. NIST is pursuing even more resources for competence as part of the FY 2005 programmatic budget initiatives.

***Strategic Working Groups (SWGs)* —** The establishment of four SWGs to help NIST-wide planning for each of the SFAs is an outstanding mechanism for implementing NIST 2010 (see Table 5). The purpose of these SWGs is to identify strategic opportunities in an SFA, facilitate internal technical coordination, and enhance collaboration and support. Comprised of multi-disciplinary technical staff from different Operating Units at NIST, these SWGs will be in an ideal position to assess

Table 4. Competence Program: FY 02 - 05

SFA	Project Title and Contributing OUs	Start	$K/year
Nanometrology	SuperResolution, In-situ Microscopies for Characterization of Nanostructured Materials (CSTL, PL)	FY 05	$400
	Metrology to Enable the Realization of Organic Electronics Devices (MSEL, EEEL, CSTL)	FY 05	$800
	Phase-sensitive Scatterfield Optical Imaging for Sub-10 nm Dimensional Metrology (MEL, PL, ITL)	FY 05	$600
	Metrology of Semiconductor Quantum Nanowires Enabling Improved Sensor, Security, and Biomedical Systems (EEEL, CSTL, MSEL)	FY 05	$500
	Nano-scale Engineered Sensors for Ultra-low Magnetic Field Metrology (EEEL,PL, MSEL, ITL)	FY 04	$850
	3D Chemical Imaging at the Nanoscale (PL, MSEL, ITL)	FY 04	$780
	Neutron Metrology for Fuel-Cell Technology (PL)	FY 04	$423
I/KM	An Integrated-Circuit Quantum Computer (EEEL)	FY 03	$760
	Quantum Information Theory and Practice (PL, ITL)	FY 03	$500
Homeland Security	Complex System Failure Analysis (BFRL, ITL)	FY 04	$800
Biosystems and Health	Metrology for Gene Expression (CSTL, ITL)	FY 05	$800
	Metrology for Tissue Engineering: Test Patterns and Cell Function Indicators (CSTL, MSEL)	FY 02	$962
	Single Molecule Manipulation and Measurement (EEEL, CSTL, PL, ITL)	FY 02	$1,230
Measurements and Standards	Optical Atomic Clocks and Frequency Standards: Development, Distribution and New Applications (PL, EEEL, MEL)	FY 05	$800
	New Paradigms in Waveform Metrology (EEEL, ITL)	FY 05	$400

Source: Prepared by NIST and distributed to the VCAT, June 8, 2004.

Table 5. NIST Strategic Working Groups

SWG	Chair
Homeland Security	Kathleen Higgins
Biosystems and Health	Vincent Vilker
Nanotechnology	Michael Postek, Acting (Clayton Teague, Chair)
Information/Knowledge Management	Pending

NIST's roles and opportunities from a wide range of viewpoints and advise the NIST senior management on strategic direction.

- Tremendous progress has been made in the SWG for Homeland Security that was established as the first SWG in FY 2003. This SWG has been extremely active in interacting with representatives from DHS and other agencies and groups; preparing a comprehensive inventory of NIST's homeland security activities; and developing a draft strategic plan.

- The Biosystems and Health SWG was formed in early 2004 and its members are actively participating in numerous meetings with industry and other government agencies, including the Advisory Council Meeting for the National Institute of Bioimaging and Bioengineering and the Annual Meeting of the Biotechnology Industry Organization.

- In August 2004, NIST formed the Nanotechnology SWG. The chair of this SWG, Dr. Clayton Teague, is currently on a temporary assignment to the National Science and Technology Council as Director of the National Nanotechnology Coordination Office. Dr. Teague's extensive knowledge of government-wide activities in nanotechnology will be of great value to this group when he returns to NIST. In the interim, Dr. Michael Postek, who has been active in NIST outreach activities in nanotechnology, is serving as the Acting Chair.

- NIST recently formed a steering group for the last SWG for Information/Knowledge Management and plans are underway to begin work on this SWG in the next few months.

The Committee looks forward to learning more about the accomplishments of these SWGs at future meetings.

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NIST Computer Scientist Ross Micheals demonstrates a NIST-developed system for studying the performance of facial recognition software programs. NIST will use results from the research in support of its Congressional mandate under the USA PATRIOT Act to certify the use of biometrics such as digitized photos and fingerprints in passports and visas.

Operating Units' Operational Plans — NIST 2010 provides a framework for the annual operational plans for each of the Operating Units. The NIST Director reviews the operational plans to ensure programmatic coordination and NIST-wide implementation of the Institute's long-range goals. The third annual Director's review of the operational plans will take place in October 2004. The Operating Units received guidance for preparing their operational plans that provided a direct link to NIST 2010. For the FY 2005 - 2006 planning cycle, the operational plans will identify

Table 6. SFA Portfolio

NIST OU SFA Planning Levels: FY 2003-2004

$M (nominal)

	FY 2003	FY 2004	Change
Nano	$62.9	$65.0	3.3%
Bio / Health Care	$31.1	$30.4	-2.2%
Information / KM	$62.6	$63.2	1.0%
Homeland Security	$41.6	$49.1	17.9%
Total SFA	$198.3	$207.7	4.8%

Notes:

Data represent Laboratory OU plans and estimates as of Nov. 2003

Data include all laboratory revenue sources

Data provided for internal planning purposes; not official NIST budget or spending data

Source: NIST Acting Director presentation to the VCAT, Sept. 14, 2004.

programs or major activities in support of SFAs and other goals; associated resources; programmatic changes from FY 2004 and their impacts, including staffing and other agency support; and other significant issues. New details will be collected on the alignment of the Operating Units' investments with industry needs. A comparison of the FY 2003 and FY 2004 planning levels indicates that NIST 2010 is being implemented as programs are increasingly aligned with the SFAs as shown in Table 6.

Table 7. MOUs Initiated with NIST in FY 2004

• Department of Defense (DoD)	• Allows small manufacturers access to DoD's technologies and expertise via the MEP.
• Maryland Technology Development Corporation	• Establishes mutually beneficial links between NIST and technology-oriented small businesses throughout Maryland.
• National Cancer Institute	• Partners with the Nanotechnology Characterization Laboratory in the standardization of promising nanomaterials for cancer detection and treatment.
• National Science Foundation	• Calls for joint research and engineering programs; partnerships to create national centers of excellence; and mutual use of facilities.
• Northern Virginia Technology Council	• Establishes mutually beneficial links between NIST and technology-oriented small businesses throughout Virginia.
• University of Illinois	• Addresses research issues related to buildings and fire, materials, and health care.

Strategic Partnerships — NIST is continuing to build strategic partnerships as a way to maximize programmatic leverage and impact for implementing NIST 2010. Over the past year, the NIST Director, the NIST Acting Director, other senior managers, and staff have been actively engaged in pursuing new strategic partnerships with several organizations, including NIH and the University of Maryland. Opportunities for strategic partnerships with these and other organizations appear very promising. In FY 2004, NIST initiated six new Memoranda of Understanding (MOUs) with the Department of Defense (DoD), the Maryland Technology Development Corporation, the National Cancer Institute (NCI), the National Science Foundation, the Northern Virginia Technology Center, and the University of Illinois as summarized in Table 7. In recognition of the many other opportunities for high-leverage partnerships that are available to help implement NIST 2010 and the amount of effort required to pursue these partnerships, NIST would benefit by developing a formal plan for identifying and targeting specific partnership organizations that will result in strategic partnerships that can best meet the nation's needs.

Strategic Focus Areas

NIST has a lead role in providing the measurements and standards for cutting-edge technologies where the United States must be competitive in the global market. In response to industry needs for measurement methods, tools, and data for emerging technology-based industries (that are determining the global winners in the early 21st century), NIST is expanding its capabilities in three SFAs: nanotechnology, biosystems and health, and information/knowledge management. NIST also is successfully applying its measurement and standards competencies to high priority needs in homeland security, the Institute's fourth SFA, by providing technical and performance measurements and standards that serve as the critical infrastructure needed for public safety and security. The repositioning of the SFAs in version 1.b of NIST 2010 to one of three objectives under a single goal for the NIST laboratories will provide the Institute with more flexibility to address other emerging technology-based industries that may evolve over time in response to changing technology and market conditions. NIST's research activities in the SFAs are progressing well and show great promise, with several noteworthy activities and accomplishments.

The VCAT applauds NIST progress in establishing interdisciplinary SWGs for each of the SFAs to identify opportunities where measurements and standards are needed in each of these areas and in providing increased competence and other funding for related projects. NIST should further expand its efforts in the SFAs to help the United States become competitive in these rapidly growing fields. In addition, NIST should continue exploring opportunities for extensive collaborations and partnerships in each of the SFAs to leverage its resources.

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NIST research structural engineer Nicholas Carino (retired) describes how he is testing the mechanical strength of fireproofing materials used in the World Trade Center (WTC) buildings. These tests will help NIST investigators estimate the amount of fireproofing that was dislodged from various structural elements within the WTC buildings when the aircraft were flown into them on Sept. 11, 2001.

Homeland Security – NIST is focusing its tremendous measurement and standards expertise to address chemical, biological, radiological, nuclear, and explosive threats (CBRNE); cyber security and critical infrastructure protection; and biometric technologies for enhanced border security. In particular, NIST's extensive activities in biometrics support the USA PATRIOT Act and the Enhanced Border Security and Visa Entry Reform Act while NIST's investigation of the World Trade Center will result in recommended improvements in the design, construction, maintenance and use of buildings, especially high-rises. NIST also is working closely with DHS in such areas as first responder communications.

Biosystems and Health – With NIST's highly specialized facilities and equipment and multidisciplinary competencies in the physical sciences, engineering, information technology, and especially nanotechnology, the Institute is uniquely positioned to provide valuable resources to the bioscience community. NIST's quantitative measurements and standards, methods, tools, and data are needed by industry, academia, and other government agencies for biosciences research, new health care technologies, and better health care delivery systems and processes. For example, NIST has been seeking partnerships with other key agencies that increasingly rely on NIST's measurement and standards competencies, including NIH, particularly NCI and the National Institute for Biomedical Imaging and Bioengineering (NIBIB), the Federal Drug Administration, and others.

Nanotechnology – NIST's unique capacities in nanoscale measurement and data characterization provide critical infrastructure for nanotechnology research and development. For example, NIST performs long-term nanoscale R&D in support of the National Nanotechnology Initiative (NNI), specifically in nanoscale metrology and instrumentation as well as manufacturing at the nanoscale.

Information/Knowledge Management – NIST's research activities are focusing on new measurement capabilities,

tests, and standards that enable more effective intelligent systems and control processes and improve interoperability within and across systems. The VCAT anticipates increased effort in this area during the coming year, with the formation of a new SWG and increased attention from senior managers.

In addition, the Committee had the opportunity to tour several NIST laboratories over the past year where excellent research is being conducted in support of the SFAs (see Appendix B, Examples of Technical Excellence).

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Physicist Deborah Jin, winner of the MacArthrur Genuis Award, in her laboratory at JILA, a joint institute of NIST and the University of Colorado, Boulder, CO.

Renewed Focus on Core Metrology and Standards

The renewed focus on core metrology and standards in version 1.b of NIST 2010 will help assure the availability and efficient transfer of measurement and standards capabilities to manufacturing service industries, universities, and other R&D-intensive organizations. The NIST laboratories are continuing to make advances in this traditional role as reflected in the laboratory tours provided to the VCAT as well as by the number of external awards and wide media attention in recognition of this work (see Appendix B, Examples of Technical Excellence).

As part of this effort, NIST is actively collaborating with the International Trade Administration to implement five components of the Standards Initiative launched in 2003 by Secretary Evans. This Initiative responds to industry concerns that standards and technical regulations have become major challenges to expanding U.S. exports.

Extramural Programs

Advanced Technology Program – At the December 2003 VCAT meeting, the ATP Director and Mr. Ross Armbrecht, Jr., President of the Industrial Research Institute and a member of the ATP Advisory Committee, highlighted ATP's benefits to the nation. ATP's mission is to accelerate the development of innovative technologies for broad national benefit through partnerships with the private sector. Since its inception in 1988, ATP has invested in more than 240 new technologies - products, processes, and services - that have been commercialized. The ATP Advisory Committee concurs with the findings of the National Research Council that ATP is an effective federal partnership program that has shown considerable success in advancing technologies that can contribute to important societal goals. In addition to ATP cost-shared awards for projects led by small and/or large businesses, other ATP participants include universities and national laboratories. ATP-funded projects cover a wide range of technology areas, including materials/chemistry, biotechnology, information technology, and electronics/

photonics. ATP investments align well with NIST's SFAs in projects conducted externally as well as in the NIST laboratories. Although recent program assessments and a survey of ATP applicants have reported significant economic benefits to the nation associated with ATP, the program is faced with the challenge of operating under financial instability as the Administration and Congress continue to debate the program's role. The Secretary of Commerce, the National Research Council, and the ATP Advisory Committee have released several reports that address ATP's funding problems.

The ATP Advisory Committee noted that ATP is increasingly respected in industry and fills a critically important gap by funding high-risk enabling technologies, but policy makers have misconceptions about the program and need to be educated on its importance. Furthermore, the ATP Advisory Committee commended ATP for its improved processes and its impressive economic assessment program and recommended that it seek synergistic opportunities with other agencies and strengthen ties with universities and state agencies. ATP already is exploring new strategic partnerships with the states, universities, and other government agencies, including DHS and NIH, to find new ways to leverage its technology funding. The VCAT recognizes the need for ATP funding to be stabilized; however if the program is terminated, there must be adequate funding to allow for an orderly shutdown of the program.

Manufacturing Extension Partnership – The severe FY 2004 budget reduction for MEP of $66 million, a 64 percent decrease from last fiscal year, disrupted program operations and resulted in staff reductions. This reduction followed a series of significant milestones for MEP. By the end of 2003, MEP reached its funding scheme goal where the MEP Centers were supported with one-third of their funding from revenues, one-third from the federal investment, and one-third from state matching funds. NIST predicted that a decrease in the federal investment would most likely lead to a decrease in state funding. The approximately $90 million in revenues demonstrated a market for the nearly 400 MEP service locations comprised of over 1,800 field staff and over 3,500 affiliated service providers throughout the United States. A recent survey of 5,015 client companies reported that, as a result of MEP services, they realized almost $681 million in cost savings; invested $940 million in modernization, including plant and equipment, information systems, and workforce training; increased or retained $2.8 billion in sales; and created 8,966 jobs and retained over 26,062 jobs. In addition, Harvard University's Kennedy School of Government selected MEP as one of 15 finalists for the 2004 Innovation in American Government Award.

MEP has undertaken extensive strategic planning to address the future direction of the program. A series of proposals to strengthen and reform the MEP were included in the Administration's Manufacturing Initiative Report that calls for closer coordination of the MEP with other Federal programs. NIST has been actively pursuing these strategic partnerships. To date, a five-year Memorandum of Understanding has been signed to provide small manufacturers access to DoD technologies and expertise through the MEP. In addition, the National Academy of Public Administration (NAPA) conducted a thorough review of MEP and developed several recommendations for alternate business models, and the Department of Commerce (DoC) and NIST are committed to implementing many of these recommendations. Stakeholder input about the next generation MEP also was generated through a series of workshops, meetings, and webcasts with 277 participants including many representatives from the state and local government. Many of these stakeholders expressed serious concerns over the proposed system-wide recompetition. The VCAT applauds MEP's leadership for its endeavors to make MEP an even more effective program that will help the nation's small and medium-sized manufacturers become more competitive and recognizes the importance of a stabilized budget to more efficiently reach this goal.

Baldrige National Quality Program – The VCAT continues to recognize the Baldrige program as one of the government's most highly leveraged and effective programs that help organizations achieve performance

excellence. President Bush presented the prestigious Malcolm Baldrige National Quality Award (MBNQA) to seven recipients in March 2004. These are the most Award recipients since the program began in 1988 and the first time that recipients were named in all five Award categories. In fact, the Quest for Excellence® (QE) Conference XVI featured the seven recipients and was one of the largest QE Conferences held. In addition, applications for the 2003 and 2004 Awards were 40 percent higher than in 2002. Furthermore, a recent Booz Allen Hamilton study reported that over 70 percent of Fortune 1000 companies are likely to use the Baldrige criteria in the next five years. With the recent approval of the new nonprofit category, the Baldrige criteria will now cover all sectors of the economy.

The VCAT was privileged to hear Sister Mary Jean Ryan, CEO of SSM Health Care (SSMHC), speak so passionately about SSMHC's organizational transformation and benefits inherent in following the Baldrige process. With over 20 acute care hospitals and nursing homes in four states, SSMHC became the first health care organization to receive the MBNQA in 2002. Sister Mary Jean Ryan described how SSMHC used the Baldrige criteria to achieve performance excellence with outstanding results in such areas as reduced employee turnover, improved financial performance, and increased patient satisfaction. Sister Mary Jean Ryan's efforts in helping other organizations use the Baldrige process to achieve performance excellence are commendable.

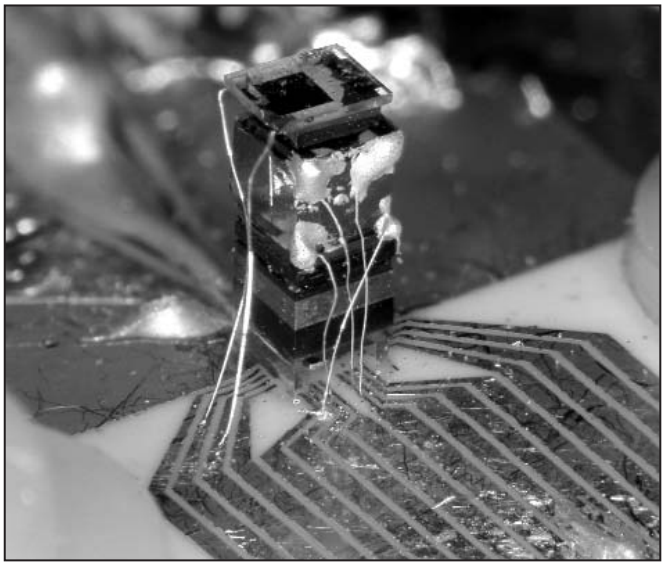


Photo credit: NIST

The "physics package" of the chip-scale atomic clock includes (from the bottom) a laser, a lens, an optical attenuator to reduce the laser power, a waveplate that changes the polarization of the light, a cell containing a vapor of cesium atoms, and (on top) a photodiode to detect the laser light transmitted through the cell. The tiny gold wires provide electrical connections to the electronics for the clock.

Performance Evaluation

Background – The NIST performance evaluation system is improving and still evolving. The VCAT commends NIST for engaging in extended discussions with the Committee regarding ways to improve its performance evaluation system and its responsiveness to the Committee's recommendations. NIST recognizes the importance of performance evaluation as it continues to refine a system that can be responsive to a diverse stakeholder community and to the internal needs of the organization. These stakeholders include the DoC, the Office of Management and Budget, the Office of Science and Technology Policy (OSTP), House and Senate authorizing and appropriations committees, the VCAT, and other Federal Advisory Committees for each of NIST's extramural programs. NIST is challenged with fundamental issues associated with reporting results on an annual basis: the NIST mission requires a complex evaluation system; NIST does not have a "few vital outcome-oriented metrics;" and performance data is not synchronized with the budget cycle.

To respond to these external requirements, NIST uses four types of evaluation tools that provide critical input to the Institute's long-term strategic planning and to NIST's value chain: external peer assessment, quantitative output metrics, customer satisfaction data, and economic impact studies. Since there are strengths and weaknesses associated with each of these measurement methods, NIST appreciates the need to further refine these methods and to balance their use. Furthermore, NIST has identified a complex set of issues in evaluating research outcomes and research investments for consideration as they attempt to evolve their performance evaluation system. These include methods for measuring the

impact pathways within and across supply chains, evaluating the productivity of laboratory functions, and validating scientific and technical judgment. The VCAT appreciates the complexity of these challenges and supports NIST in exploring ways to address them.

Economic Impact Studies – Improvements are still needed in NIST's use of economic impact studies. Over the past ten years, NIST has conducted over 31 retrospective economic impact studies of its programs in selected areas that have shown extraordinary benefits. However, prospective economic impact studies also are needed to help assess the downstream impacts of NIST's research projects and infratechnologies. These prospective studies would help to validate NIST's role in emerging technologies. Pending the availability of adequate resources in FY 2005, NIST plans to carry out new prospective economic impact studies to refine the anticipated impact statements specific to the research objectives within each SFA as described in version 1.b of NIST 2010. The Committee also advised NIST on the importance of collecting cumulative data from five to ten years after a project has been completed to further measure its economic impact.

Performance Metrics – Performance evaluation is important internally to NIST to evaluate its current work portfolio and retrospective performance. Starting in FY 2004, NIST adopted a Balanced Scorecard approach to define NIST-wide performance goals and metrics, as recommended by the VCAT. The Scorecard was used to evaluate organizational performance and senior management performance, and provided the needed framework for cascading metrics and evaluation methods throughout all levels of the organization. The NIST Customer and Stakeholder Council is revising the Scorecard for 2005 to include new types of customer satisfaction methods also recommended by the VCAT. The Committee recommends that NIST develop more short- and long-term metrics and other quantitative data for evaluating progress in implementing NIST 2010.

Board on Assessment of NIST Programs – The National Research Council (NRC) Board on Assessment of NIST Programs provides qualitative peer review of NIST laboratory programs. Dr. Kenneth Keller, Chair of the Board on Assessment of NIST Programs, attended the September 2004 VCAT meeting. He presented the Board's new biennial assessment process, evaluation criteria, and expectations for the FY 2005 NRC report. The Board is charged with assessing the technical merit of the laboratory programs relative to state-of-the-art worldwide; the effectiveness with which the programs are carried out and the results disseminated; the relevance of the programs to the customer's needs; and the adequacy of the laboratories' facilities, equipment, and human resources.

The new biennial review process is intended to provide the Board with more time to gather and analyze the information for an improved report based on a set of common assessment criteria and themes. The biennial review process began in FY 2004, the "off" year, as individuals or sub-groups of panels met informally with NIST scientists to become more familiar with laboratory activities. FY 2005 will be the "report" year with formal panel visits, assessments, and feedback followed by Board meetings and the writing, review, and issuance of the final report. During this process, the panel members will be involved with gathering information using common assessment criteria while the Board's responsibilities will include selecting the themes, screening the panel assessments for the relevant information, and engaging in the review process and writing the report. The Board is still in the process of selecting themes for the FY 2005 report based on NIST 2010 and discussions with the NIST laboratory directors. In addition, the Board recognizes the need to assess multi-disciplinary activities and its lack of structure to adequately address this task. The VCAT is available to pursue further discussions with the Board about our unique roles and to provide any other advice that it deems appropriate to more effectively carry out its assessment of NIST programs.

ORGANIZATIONAL EXCELLENCE

Ultimately, the combination of world-class talent and highly specialized facilities and equipment will ensure NIST's success in meeting the measurement and standards challenges of the future. The VCAT congratulates NIST for completing the construction of the AML on time and within budget after ten years of planning. NIST also is making progress towards achieving organizational excellence in regard to its people. The pay for performance system has been redesigned to effectively address staff concerns over fairness and transparency. In addition, NIST senior management's increased emphasis on safety has resulted in an improved safety record for Gaithersburg and Boulder staff.

Courtesy HDR Architecture, Inc./Steve Hall © Hedrich Blessing

NIST's new Advanced Measurement Laboratory is the most technically advanced research facility of its kind in the world. The $235 million, 49,843 square meter (536,507 square foot) facility features five separate wings with stringent environmental controls on air quality, temperature, vibration, and humidity.

Facilities

NIST is well along in its planning to upgrade its aging physical plant. As described in the "Summary of Observations, Budget" section of this report (page 4), significant budget increases are still required to fully equip and take maximum advantage of recent investments in the AML, to overcome deficiencies associated with the aging buildings, and to improve the capacity and operational efficiency of the NCNR. NIST has thoroughly evaluated its facilities needs, and is pursuing a prudent plan for addressing the highest priority plant and equipment improvements that NIST's scientists and technical staff need to remain at the forefront of measurement and standards research and development.

- ***AML*** – The four hallmarks of the AML are its stringent environment controls on air quality, temperature, vibration, and humidity as described in Table 8. These unique capabilities provide an excellent opportunity for industry, university, and government collaborators to achieve more rapid advances in research and development through advanced measurements, standards, and reference materials critical to innovation in nanotechnology and other emerging technologies.

Table 8. Advanced Measurement Laboratory (AML)

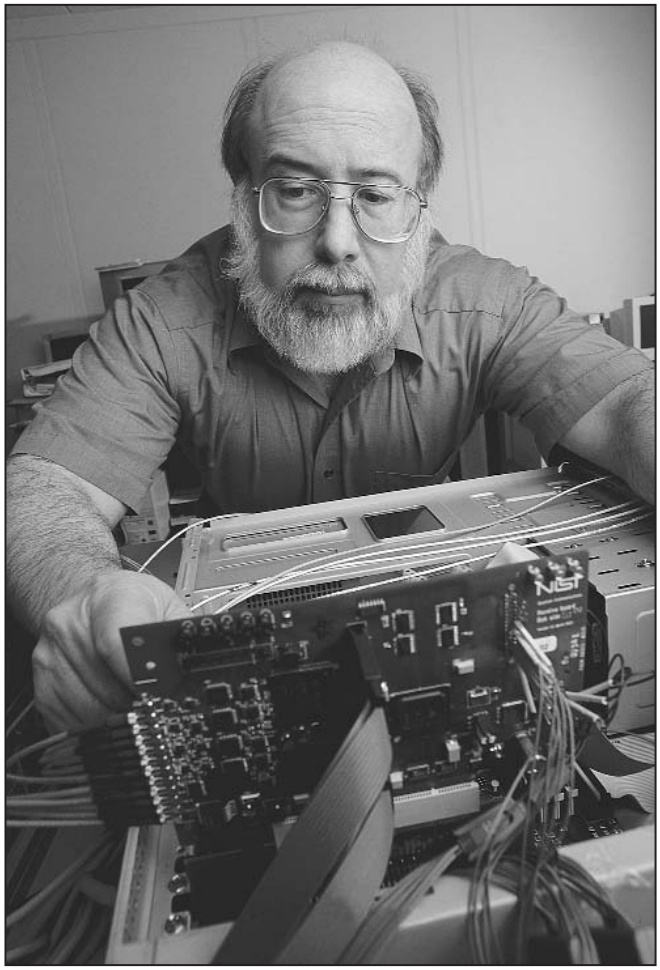
Unique combination of precisely controlled lab environments:

- Two (2) single-floor instrument laboratory sections above ground with 187 lab modules; two (2) single-floor metrology laboratory sections completely below grade with 145 lab modules
- One (1) above-ground Class 100 clean room wing upgradable to Class 10
- Temperature control to within +0.1 or +0.01 degree Celsius for 48 precision temperature control laboratories in metrology section
- Several types of vibration isolation foundations in metrology laboratory sections for a velocity amplitude of three micrometers per second or less

Source: NIST Chief Facilities Management Officer presentation to the VCAT, March 16, 2004.

- ***NCNR*** – According to a 2002 report by OSTP, the NCNR ranks as the "highest performing and most used neutron facility in the United States." Serving more than 1,900 researchers from university, industry, and government, the NCNR's neutron probes are becoming increasingly indispensable research tools in fields ranging from nanotechnology to superconductivity and from fuel cells to biotechnology. Capability improvements at the NCNR are needed to maintain and expand these collaborations.

- ***Upgrade and Maintenance of Other NIST Facilities*** – Upgrades are required to preserve and enhance NIST's technical contributions to national innovation and economic growth. According to a recent Facility Condition Assessment of the NIST Gaithersburg campus performed by Hanscomb, Faithful & Gould (HF&G), all but three of the buildings and structures inspected received a Facility Condition Index score of poor. Furthermore, the study identified $512 million in facility deficiencies. This estimate was based on inspections performed on each of the major structures' building exterior systems; building interior systems; heating, ventilating, and air-conditioning and plumbing systems; and electrical systems. The study did not document facilities on the Boulder campus, but the results would probably have been worse since the buildings are older. HF&G calculated the current replacement value for the Gaithersburg campus as $1.49 billion, and estimated Boulder at $327 million.



© Robert Rathe

NIST electrical engineer Alan Mink works on a programmable printed circuit board used to process data for the new NIST quantum key distribution system.

Technical Excellence

NIST continues to be a high-performing organization with outstanding achievements in ground-breaking scientific research in FY 2004. Examples include the creation of a new form of matter and the demonstration of the fastest known cryptographic system for quantum encryption. As these and many other examples indicate, NIST has world-renowned scientists and engineers, including two Nobel Laureates and some of the world's most specialized measurement facilities. With these assets, NIST is well-positioned to remain at the forefront of research and services that support all phases of scientific and technological development (see Appendix B for illustrative examples of NIST's technical excellence).

People

The People Council continues to explore policy issues relating to NIST staff as delegated by the Senior Management Board. With broad representation from all levels of NIST in both Gaithersburg and Boulder, the Council has been involved with NIST's long-term Human Resource (HR) strategy, the NIST Diversity Strategic Plan, the Leadership and Management Development Program, and the pay for performance

system. Based on a comprehensive review of existing HR-related reports and plans spanning the past 10 years and results from the Employee Surveys, the Council's preliminary findings indicated that NIST needs better training for its leadership; needs a growing commitment to diversity by senior leadership; needs to fully utilize the talents, competencies and experiences of its staff; and needs to change a number of processes to ensure fairness, including the Performance Management System. These are important issues for NIST to address as the Institute seeks to attract and maintain a high quality staff.

The goal of the NIST Diversity Strategic Plan is to produce preeminent performance through diversity. The plan's objectives were shared with the Committee and NIST was encouraged to examine the issue of diversity as a business case to determine its value to the organization. NIST plans to conduct further benchmarking with comparable scientific organizations to help set its diversity goals.

Leadership and management is a critical issue addressed by every organization. NIST has established four major initiatives to facilitate leadership and management development that focus on identifying core leadership competencies and developing training programs aimed at existing leaders, next generation leaders, and newly appointed leaders. The VCAT commends NIST leaders for benchmarking the Institute's leadership and management training and policies with other organizations as recommended by the Committee.

A major accomplishment of the People Council is the redesign of the NIST pay for performance system, pending approval by DoC and the Office of Personnel Management (OPM). NIST has been using a pay for performance system for more than a decade to expedite the hiring process and to reward high-performing staff. OPM evaluated NIST's pay for performance system for the first seven years and reported that by using this system NIST is more competitive for talent and retained more top performers than the comparison group. However, NIST leaders decided to redesign the system to address issues of fairness and transparency identified in the most recent employee survey. The proposed system calls for numerical ranking and scoring to be replaced by performance levels. In addition, pay increase percentages will be comparable for all employees within a level in each career path within an Operating Unit. The proposed redesign was presented to the staff for comments and about 62 percent preferred the redesign. Since the redesigned system is responsive to staff concerns, NIST expects improved staff performance and morale once the new system is implemented.

Retaining and building world-class competencies in the SFAs is crucial and depends on a long-term strategic plan for managing human resources. NIST is currently evaluating the specific talents and skills needed in each SFA as the Institute seeks to improve its human resource planning. This plan becomes even more important as the Institute strives to identify opportunities for partnerships requiring specialized staff expertise.

Safety

NIST management is demonstrating its commitment to making safety a top priority by setting a goal of zero lost workday incidents and establishing a number of new practices to help achieve this goal. Safety results, incident reports, and mitigation/response strategies are discussed at the outset of each Senior Management Board meeting. In addition, the NIST Director created a Safety Council to provide the Senior Management Board with information, advice, and policy options to ensure NIST's preeminence in safety and to annually update the NIST Safety Plan. To implement NIST-wide activities required by the Safety Council and the Safety Plan, a Safety Operational Committee was established. The Vice Chair of the Safety Council chairs this committee and has parallel vice chairs from Gaithersburg and Boulder in recognition of the uniqueness of the two campuses. Representatives from each Operating Unit and administrative functional area serve on this committee. Their major projects will include updating safety manuals and personal protective equipment procedures and implementing safety training for all staff. NIST has developed a more effective Institute-wide

management system that encourages incident reporting and incorporates training, hazard identification, and related management strategies.

The FY 2004 NIST-wide Balanced Scorecard metrics for safety have an initial target reduction of 25 percent in lost workday incident frequency and severity rates from the previous five-year average. NIST exceeded this target in FY 2004 with a 30 percent reduction over the previous five-year average. A four-hour mandatory safety training session for new employees is in place. The FY 2004 Safety Plan also includes specific activities focused on reducing the highest incident rates that occurred in the Office of the Director for Administration/Chief Financial Office between FY 2000 through FY 2003 in both Gaithersburg and Boulder largely due to plant and facilities personnel that face greater risks of injury. The Committee is pleased that NIST's lost workday incident rates are decreasing, particularly in Boulder, and that NIST is benchmarking its safety data with other organizations; however NIST should extend their discussions with these organizations and other research laboratories in industry to learn even more about their specific safety practices to further improve the safety of NIST staff in and out of the workplace.

Reorganization/Streamlining (Administrative Efficiency and Effectiveness)

To help achieve organizational excellence and financial health under austere budget conditions, NIST is improving its internal operations by streamlining administrative functions, consolidating support organizations, and engaging management and administrative staff from the Operating Units in decision-making. By improving administrative efficiency and effectiveness, more funding will be available for NIST's programmatic activities. For help with streamlining administrative functions, NIST appropriately benchmarked its practices against other government agencies and the private sector among other activities. NIST has already begun to reduce the management-to-staff ratio by substantially reorganizing NIST-wide administrative services to eliminate unnecessary levels of management. Under the new structure, the Chief Financial Officer, the Chief Human Capital Officer, the Chief Information Officer, and the Chief Facilities Management Officer will be reporting to the NIST Deputy Director instead of the Director of Administration. Other specific improvements include transitioning to activity-based costing, consolidating Boulder operations, establishing regular reviews of support functions, providing a forum for staff input, and establishing zero-based budgeting. Although NIST is making substantial progress in improving internal operations, the Committee continues emphasizing the importance of using the Baldrige principles for determining the appropriate level of administrative services needed throughout the organization.

Management of Organizations with Remote Sites

A VCAT panel discussion on the management of organizations with remote sites was held at the September 2004 meeting in response to a NIST Laboratory Director's request for advice on this topic. This discussion was of particular interest to NIST with about 86 percent of its employees located in Gaithersburg, Maryland; 12 percent in Boulder, Colorado; and the remaining 2 percent in a few other remote locations. Based on their experiences, the panel members addressed questions regarding managing innovation with geographically dispersed teams and administrative management. The members shared best practices covering communications, equity in operational support, relationships/networking, financial support, leadership skills, and the pros and cons of common policies. Based on the positive responses to this panel, the VCAT welcomes suggestions from NIST on other topics of interest where the members can share their experiences in more detail to help the Institute become a more effective and efficient organization in carrying out its mission.

A 40-nanometer-wide NIST logo made with cobalt atoms on a copper surface was produced at the NIST Nanoscale Physics Facility. This banner served as the backdrop for the AML dedication ceremony. The ripples in the background are made by electrons, which create a fluid-like layer at the copper surface.

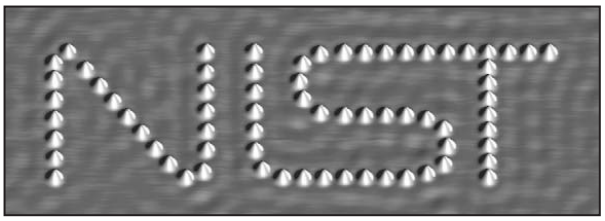


Photo credit: NIST

Appendix A. NIST Impacts, Issues, and Requests: Prepared by the VCAT, April 8, 2004

National Institute of Standards and Technology (NIST)

- ***U.S. Manufacturing is evolving from "blue collar" to "white collar", driven by innovation and new technologies. The 2004 economic recovery is not restoring traditional jobs—the only way out is "high tech."***
- ***The European Union, China and others are increasingly using standards to drive their economies and gain global market share.***
- ***U.S. industries will not be competitive tomorrow, in five or ten years, if budget limitations prevent NIST from growing to meet the challenge.***
- ***The impact of NIST is not limited to traditional manufacturing but extends to quality of life, health care, communications, construction, and homeland security.***
- ***NIST enables U.S. science and technology to be developed and commercialized and to be globally competitive.***

NIST Impacts, Issues, and Requests

NIST's measurements and standards provide the basis for ***sales totaling more than $5 trillion***--roughly half of the U.S. economy.

U.S. companies increasingly depend on NIST to help ensure access to global markets especially with other nations using standards as a competitive threat.

Without NIST, U.S. manufacturers of health-care products such as glucose and cholesterol test kits would **not** be able to meet the requirements of new European Union regulations and ***would have been shut out of European markets where they now have more than a 60% share***. Plus, NIST Standard Reference Materials have helped to ***significantly improve the accuracy of cholesterol tests***, resulting in better diagnoses and treatments and an estimated annual savings of about $100 million.

U.S. ***automakers and their suppliers***, which account for more than 3% of the nation's GDP, ***rely on NIST Standard Reference Materials*** to ensure quality in a wide range of tasks, from the processing of materials to final assembly, to emissions compliance.

NIST's contributions to the development of encryption standards for information technology are estimated to have ***saved private industry more than $1 billion***, while enabling consumers and business to be confident about the ***security of their billions of dollars worth of daily electronic data transactions***, such as withdrawals from ATMs.

NIST developed the testing procedures and other key technical elements of the Department of Homeland Security's performance ***standards for radiation detectors used at seaports, airports***, and other points of entry into the United States, as well as ***protocols for mail decontamination during the anthrax crisis***.

NIST manages the ***Malcolm Baldrige National Quality Program***, a partnership with the private sector, which provides a sustaining framework and criteria used by thousands of companies, schools, and hospitals to improve their products and services.

About ***2,700 law-enforcement officers have been spared from death or disabling injury*** as a result of NIST-developed standards for ballistic-resistant body armor ("bullet-proof" vests).

National Institute of Standards and Technology (NIST)

NIST's Core Mission— measurements and standards

- Mission assigned to federal government by the Constitution
- Unique—not done by the private sector, nor other US agencies
- Only U.S. agency chartered to ***help*** business
- Includes basic science underlying measurements and standards and direct transfer to companies
- Measurements and standards provide infrastructure for the entire economy, manufacturing, commerce, and international trade

NIST Today

- Budget: $608.5M (FY 2004); Employees: 3,000
  - 0.5% 2004 Overall Federal R&D Budget
  - 1.1% 2004 Non-defense R&D Budget
- Major Program areas: NIST Laboratories (STRS), Manufacturing Extension Partnership Program (MEP), Advanced Technology Program (ATP), Baldrige National Quality Program (BNQP)
- Well-managed, continuous improvement following strategic plan.
- NIST Laboratories (STRS)
  - Conducts research that advances the nation's technology infrastructure and is needed by US industry to continually improve products and services;
  - Responds to industry needs for measurement methods, tools, data, and technology
- Four Strategic Focus Areas Planned:
  - Nanoscale measurement and standards
  - Biosystems and health
  - Information and knowledge management
  - Homeland Security measurements and standards
- MEP (recent survey, of 5,015 client companies)
  - Realized almost $681 million in cost savings;
  - Invested $940 million in modernization, including plant and equipment, information systems, and workforce training;
  - Increased or retained $2.8 billion in sales; and
  - Created 8,966 jobs and retained over 26,062 jobs.
- ATP
  - More than 240 new technologies--products, processes, and services--have been commercialized;
  - Rate of return on ATP investments to date is nearly $8 to $1; and
  - Called the "godfather" of what is now a $1 billion biochip industry, projected to grow at an annual rate of almost 20%.

- BNQP
  - Called the Nobel Prize of Business; responsible for making quality a national priority and disseminating best practices across the US, and it is the world-wide standard for performance excellence;
  - Beneficiaries are companies, schools, hospitals, industries, the national economy, and U.S. competitiveness; and
  - Total economic benefit is estimated at almost $25 billion, for a benefit-cost ratio of 207 to 1.

The Budget Dilemma

- Zero growth in real resources for core mission since 1997
- Squeezed by adjustments to base, unfunded mandates
- Politics of ITS (ATP and MEP) — squeezes core mission
- Problem of diffuse support—no focused constituency
- Risks damage to key national asset just when economy is struggling

The Essential Requests

- Support the President on STRS (NIST Laboratory Programs)
- Restore MEP funding to previous levels ($120M)

Appendix B. Examples of Technical Excellence: Lab Reviews Conducted by the VCAT in FY 2004

Technical excellence is evident in many of NIST's programs as reflected by the prestigious awards bestowed upon the technical staff for outstanding accomplishments; NIST's responsiveness to Congressional mandates in high visibility areas; NIST's technical accomplishments that are featured in the scientific media; and the high quality research presented to the VCAT members during selected laboratory tours.

Examples of prestigious external awards that recognize NIST accomplishments include the MacArthur Genius Award to Deborah Jin for the first observation of a fermionic condensate formed from pairs of atoms in a gas; Service to America Medals finalists in the areas of superconductivity and DNA identification; the International Society for Forensic Genetics Award; and the Arthur S. Flemming Awards. Scientific journals and other news media also have highlighted NIST technical achievements.

At each meeting, the VCAT members tour selected NIST laboratories to gain an appreciation of the high quality technical work and staff expertise that prevail at both campuses. These tours also provide the Committee with an excellent opportunity to examine how the technical programs support the NIST Strategic Plan. Provided below is a brief summary of the FY 2004 tours that illustrate the technical excellence of NIST's programs, their impact to the nation, and their relationship to the NIST Strategic Plan. In addition, the Committee was extremely impressed with each of the researchers' depth of knowledge and enthusiasm as they described their exciting projects.

Measurement Science

Quantum Computing with Ions – NIST is successfully addressing some of the most challenging measurement problems in the physical sciences that place NIST at the scientific forefront. This world-class research at NIST has demonstrated several firsts in quantum computing and quantum state engineering, including the first demonstration of all the components needed for a scalable computer, the first demonstration of quantum teleportation to rapidly transfer information in a quantum computer, and the first demonstration of using quantum mechanics to substantially reduce measurement uncertainty. This research is expected to lead to the exciting development of quantum computers vastly more powerful than today's best supercomputers. Part of the NIST Quantum Information Program, this project is an excellent example of successful cross-collaboration among the NIST laboratories with expertise from the Physics Laboratory, the Information Technology Laboratory, and the Electronics and Electrical Engineering Laboratory. The project is partially supported by the National Security Agency/Advanced Research and Development Activity and the NIST competence program. The highly acclaimed research was widely publicized in scientific journals, including *Nature* (cover story), and in other media.

Chip-Scale Atomic Clock – For decades, NIST has been a world leader in the development of new technologies for measuring time and frequency. In the latest advance in time keeping, NIST has been successful in bringing together the diverse competencies needed to design, fabricate, and characterize ultraminiature atomic clocks. These atomic clocks provide an entirely new dissemination channel for NIST's ability to measure time. This effort is part of a Defense Advanced Research Projects Agency (DARPA)-funded consortium with several companies to develop atomic clocks about the size of a grain of rice that could be powered by an AA battery and stable to 1 part in 10 billion, equivalent to gaining or losing just 1 second every 300 years. NIST is close to meeting these requirements, and is demonstrating the use of micro-electro-mechanical systems (MEMS) fabrication techniques that could someday be used to mass produce inexpensive, ultraminiature atomic clocks for use in such applications as wireless telecommunications, enhanced global positioning system (GPS) receivers, and communications security.

Microscale Analytical Laboratory – NIST competence funding established the foundation for a strong microfluids metrology program that has now attained international stature. The Microscale Analytical Laboratory was

established at NIST in 1998 as a five-year competence-funded project to advance the knowledge and understanding of "Lab-on-a-Chip" devices based on microfluidics technology. These microfluidic devices are miniaturized chemical and biochemical analyzers that can be used in the future for quick, inexpensive diagnostic tests of very small samples such as blood, DNA, and spinal fluid. The program has attracted additional funding from DARPA and NIH to assist in the development of microfluidic systems for homeland security, forensic analysis, and health care applications. NIST's chemists and biomedical engineers are developing techniques for improving flow through these devices and for verifying the accuracy of the analyses. A detailed understanding of the flow and mixing of fluids within the microchannels is a key to commercialization of this technology.

Biosystems and Health

Center for Mechanical Behavior of Biological Materials (CMBBM) – The CMBBM is a well-designed suite of projects that are tackling intriguing measurement problems in the life sciences through creative partnerships. NIST recognized a burgeoning need in the medical research community to understand the role that the mechanical behavior of biological materials plays in tissue-engineered structures, as well as in both normal and diseased tissues. To address these needs, NIST formed a research team and established the CMBBM to develop and promote measurements, standards, and technology for understanding the mechanics of biological materials at the cell, cell + matrix, and tissue levels. This research will enable the medical research community to grow fully functional tissue-engineered structures and understand the mechanical effects of chronic diseases and other conditions. Through the CMBBM, NIST brings its experience in physical metrology and engineering skills to bear on critical measurement and standards challenges in the life sciences. In each area, NIST is implementing these projects through external collaborations with the Colorado research science and technology community.

"Higher Order" Reference Methods and Certified Reference Materials for In Vitro Diagnostics – NIST's extensive linkages to the clinical measurements community (see Table 9) and its renown for providing internationally-recognized standards makes the Institute uniquely qualified to respond to U.S. manufacturers' request for help with exporting in vitro diagnostic medical devices (IVD MD). Approximately 60 percent of the IVD MD currently on the $6 billion per year European market are imported from the United States. The U.S. IVD manufacturers have requested that NIST provide the internationally recognized "higher order" reference methods and certified reference materials required for them to meet the new European Directive on traceability in order to continue to export their IVD devices to Europe. To help achieve this goal, NIST plays a lead role in the international Joint Committee on Traceability in Laboratory Medicine (JCTLM) Working Group on Reference Materials and Reference Measurement Procedures. Furthermore, NIST's clinical diagnostics program action plan calls for the Institute to provide increased comparability of clinical diagnostic measurements through provision of higher order reference methods and Standard Reference Materials for all high priority diagnostic markers identified by the U.S. IVD industry and JCTLM.

Table 9. NIST Linkages to Clinical Measurements Community

Program Guidance from:

- **American Association for Clinical Chemistry (AACC)**
- **College of American Pathologists (CAP)**
- **Federal Agencies - NIH/CDC/NCI, FDA**
- **IVD Industry - AdvaMed**
- **National Committee for Clinical Laboratory Standards (NCCLS)**
- **Joint Committee on Traceability in Laboratory Medicine (JCTLM)**

Source: Chief, Analytical Chemistry Division, Chemical Science and Technology Laboratory, presentation to the VCAT, June 8, 2004.

Cold Neutrons for Biology and Technology – The unique capabilities of the NCNR coupled with extensive bio-engineering partnerships and NIST staff expertise provide an excellent environment for achievements in biomedical research. Experiments in biology and biotechnology account for nearly 20 percent of research using the NCNR's supply of "cold" neutrons. NCNR's cold neutrons are proving to be especially useful for probing the nanoscale structure and interactions in biological membranes and for relating protein structure and dynamics to function - information key to the design of new drugs for preventing and treating human diseases. The Cold Neutrons for Biology and Technology Consortium, a collaboration of university and government scientists funded by the NIH, is using two state-of-the-art small-angle neutron scattering instruments at the NCNR to investigate the key structures and behavior of cell membranes and their components, which promise important advances in biomedical research.

Nanotechnology

NIST Nanofabrication Facility – NIST's unique state-of-the-art facilities for nanotechnology research competencies will be key to the growth of nanotechnology for the nation, and is expected to be a centerpiece for nanotechnology research in the mid-atlantic region. Located in the newly constructed AML, the NIST Nanofabrication Facility is an approximately 1500 square meter Clean Room with 12 Class 100 bays. NIST's vision for this facility is to enable the fabrication of prototypical nanoscale test structures, measurement instruments, standard reference materials, electronic devices, MEMS, and bio-devices critical to NIST's SFAs and the nation's nanotechnology needs.

Unique Instrumentation for Enhanced Raman Spectroscopy – NIST's unique instrumentation for enhanced Raman spectroscopy contributes to the development of methods to measure and control single biological molecules. Surface Enhanced Raman Spectroscopy (SERS) is a non-invasive, powerful, "chemical vision" technique interfacing nanotechnology and bioscience for unprecedented sensitivity. First in-class instrumentation designed and developed at NIST allows researchers to observe the Raman vibrational modes or chemical signature of a biomolecule with ultra fine temperature and magnetic control. Plans are underway to make available these unique techniques to collaborators through the NIST Nanofabrication Facility within the AML.

Nanoscale Physics Facility – Another important component of NIST's nanotechnology research portfolio is the Nanoscale Physics Facility. This state-of-the-art facility was constructed to pursue a major program in quantum and spin electronics. The facility provides atomic resolution imaging and the ability to probe electronic structures with high electron energy resolution. A new version of this facility will be installed at the AML with a state-of-the-art cryogenic scanning tunneling microscope to create specific, perfect nanostructures.

Homeland Security

Studies to Improve First Responder Communications - NIST's core competencies in electromagnetics and wireless communications will contribute to the improved safety of rescue workers and victims. In close collaboration with the private sector and state and local officials, NIST conducted field studies on the measurements of transmitter signals from various critical emergency communication devices placed in key locations in controlled building collapses. The NIST research team actively participated in the collection of communications data from the implosions of a 13-story Fischer Public Housing Project in New Orleans in January 2004 and the Veterans Stadium in Philadelphia in March 2004. The final report from these studies has not yet been published.

NIST engineers are recording communication signals received from transmitters buried within the rubble of an imploded 13-story public housing project in New Orleans. This project is part of NIST's efforts to improve first responder communications.

Photo credit: NIST

Appendix C. NIST Response to FY 2003 VCAT Annual Report Recommendations

At the September 2004 VCAT meeting, the NIST Acting Director provided a detailed status report on how the Institute is addressing each of the twelve recommendations from the FY 2003 VCAT Annual Report. NIST has committed to provide detailed progress reports to the Committee twice a year on these and other VCAT recommendations. NIST has made substantial progress in addressing these recommendations (see Table 10). This new formal reporting system closes the loop between the VCAT's observations, recommendations, and NIST's response.

The Committee is very appreciative of the Institute's continued openness and the breadth of information and data provided on the topics presented over the course of the meetings. With this information, the VCAT is better able to advise the Institute on its policies, organization, budget, and programs to help NIST best support the nation's scientific and technical needs.

Table 10. NIST Response to FY 2003 VCAT Annual Report Recommendations

VCAT Recommendations	NIST Status
NIST 2010 STRATEGIC PLAN	Overview: NIST continues to develop its long-term planning processes, and since 2003 has systematically sought and responded to the VCAT's feedback on the NIST 2010 Strategic Plan and associated planning processes and management priorities. VCAT meetings during this time have focused on apprising the Committee of NIST's progress in implementing its long-range plans and, through lab tours, conveying the nature and value of NIST's work in its strategic focus areas and core measurement and standards responsibilities.
Implementation of the Plan	*(For broad coverage of NIST's status on this topic, see the Director's presentation to the VCAT on NIST 2010 implementation at the June 2004 meeting.)*
Continue to reflect the plan as quickly as possible in the operating plans and in real-time program decisions. (pg. 2)	NIST now uses the 2010 Plan to derive its annual budget initiatives, structure its strategic investment choices (such as Competence funding), and frame annual OU Operating Plan reviews. The third annual Director's review of OU Operating Plans will take place in October 2004. The guidance for and actual conduct of these reviews provide a direct link from NIST-wide strategic planning to OU operational planning. Data on the corresponding change in NIST's investments in its Strategic Focus Areas were provided to the VCAT in June and will be updated after the October 2004 reviews.

Provide more detail on the linkage of specific research programs to higher-level plan goals, consistent with customer needs. (pg. 2)	In the FY 2003 operating plan reviews, the Director reviewed each OU's program portfolio to assess the degree of alignment with NIST-wide strategic goals and the overall set of customer needs being addressed by each OU. The guidance provided for the Director's Review for the FY 2005 OU Operating Plans continues this assessment and requests new detail on the alignment of OU investments with industry needs.
Continue to develop a method for managing resources on a NIST-wide basis. (pg. 2)	Further progress in this direction is evident in the senior management team's decisions on and approach to annual budget initiatives; alignment of strategic and operational plans; and strategic internal investments ("Competence" funding).
NIST should continue to press for a collaborative role in facilitating measurements and standards for homeland security while working with DHS and other federal laboratories. (pg. 5)	Through the efforts of the Strategic Working Group for Homeland Security and specific OU-level interactions, NIST has worked closely with DHS and other organizations to maximize the use and leverage of NIST's competencies in such areas as biological, chemical, and radiation detection; standards and guidelines for buildings; standards for personal protective equipment; communication standards for first responders; cybersecurity; and other areas central to homeland security.
National Measurement System (NMS)	*(NIST's approach to the National Measurement System was included in a presentation by R. Kayser to the VCAT in June 2004.)*
NIST needs to strongly and broadly communicate the benefits of an NMS to identified constituents. NIST must define the overall goals of an NMS, identify its distinctive competencies, articulate why NIST should lead the effort, and gain support from involved external entities. (pg. 3)	NIST will be producing a response to this recommendation based on the work of an internal task force comprised of several laboratory Division Chiefs. This task force produced a scoping paper that was favorably reviewed by the VCAT in June; based on that response, the task force currently is conducting a broad set of interviews with customers and stakeholders and will be providing preliminary findings to the NIST Senior Management Board in November 2004. These findings will be incorporated in subsequent revisions to NIST 2010.
Performance Metrics	*(NIST has conducted extensive discussions with the VCAT regarding OMB evaluations of NIST using the Program Assessment Rating Tool, and has provided updates on new evaluation and performance management strategies, including the development and deployment of a new Balanced Scorecard performance management tool.)*

Next revision of the Plan should identify clear and reasonably direct economic benefits for each of the major elements. (pg. 5)	Version 1.b of the NIST 2010 Strategic Plan describes the anticipated impacts of fulfilling NIST's programmatic goals and specific research objectives within each strategic focus area. While the VCAT approved version 1.b in June 2004, some members suggested that NIST should seek to further develop and refine its anticipated impact statements specific to each strategic objective. Pending the availability of adequate resources in FY 2005, NIST will pursue this objective through new prospective economic impact studies.
Organization-wide performance metrics must be developed for the portfolio of NIST's projects. Levels of metrics should cascade down through the levels of the Plan with direct application to the research programs. (pg 5)	Starting in FY 2004, NIST adopted a Balanced Scorecard approach to defining NIST-wide performance goals and metrics. The Scorecard was used in FY 2004 to evaluate organizational performance and senior management performance, and provided a framework for cascading metrics and evaluation methods throughout all levels of the organization. The NIST Senior Management Board is now finalizing a revised scorecard for FY 2005.
NIST should review the Baldrige criteria for applicability toward developing a better balanced scorecard with leading indicators. NIST encouraged to include customer satisfaction measures. (pg. 5)	NIST has developed its Balanced Scorecard with the Baldrige framework in mind. In FY 2004 NIST improved its ability to conduct transactional customer satisfaction surveys, expanding coverage to include web-based content delivery as well as conferences and workshops. The revised Scorecard for 2005 calls for new types of customer satisfaction metrics, currently under development by the Customer and Stakeholder Council.
SAFETY	Overview: NIST has firmly established safety as the highest priority concern of senior management. Safety results, incident reports, and mitigation / response strategies are discussed at the outset of each Senior Management Board meeting. NIST-wide results have been reported regularly to the VCAT through the Director's update as well as through focused presentations (see B. Koch, December 2003). Current data show a successful reduction in lost workday incidents from 2003 to 2004 (year to date).
Develop a plan to include the staff in actively reducing the reportable injury rates. Suggestions include implementing a hazard identification system and reinforcing positively the reporting of incidents. (pg 6)	NIST has established and formalized a more effective NIST-wide management system for safety that encourages incident reporting and incorporates training, hazard identification, and related management strategies. Safety results are tracked monthly by the Senior Management Board, and are a key component of the NIST-wide Balanced Scorecard.

ORGANIZATIONAL EFFICIENCY	Overview: NIST began a major focus on organizational efficiency with the establishment of the Business Council in 2002.
Reorganization	*(NIST designed, submitted, and recently received formal approval of a substantial re-organization of NIST-wide administrative functions. The overall intent and rationale for these changes have been discussed with the VCAT; full implementation will be effective 10/1/04.)*
Further work is needed to define the responsibilities of the top executive team members to minimize overlap and to free the NIST Director to focus on external relations. (pg. 6)	NIST's administrative reorganization clearly defines the responsibilities of NIST's top executive team. A key element of this reorganization included the establishment of a Chief of Staff to the NIST Director, with the explicit goal of enhancing the Director's focus on external relations. Indicators of success during FY 2004 include: The NIST Director made significant contacts with SIA, CCR, APS, AIAG, GM, UTC, Agilent, Honeywell, Oracle, DuPont, Dow, NACFAM, and others; delivered numerous presentations to various scientific and engineering societies; and provided program and budget briefings for key associations and companies. One indicator of success: More than 110 customers signed a letter to Congress developed by a new Coalition for NIST. Key congressional staff indicated customer advocacy was being recognized in appropriations deliberations.
Strategic Partnerships	*(As discussed with the VCAT in June, strategic partnerships are a fundamental implementation channel for NIST's long-term strategic plan, NIST 2010. NIST's overall approach was discussed with the VCAT in June 2004, and progress reports have been provided on a regular basis through Director's updates to the VCAT.)*
Continue to develop partnership models, possibly with a large virtual component, with institutions remote from NIST's physical locations. (pg. 7)	NIST has a sustained and focused effort to maximize programmatic leverage and impact through strategic partnerships, building on the existing successes with JILA and CARB. NIST's efforts during FY 2004 have focused on the NIH, NSF, University of Maryland, and University of Illinois.
Budget	*(NIST's budgetary requirements and circumstances have been a sustained focus of discussion with the VCAT throughout FY 2004.)*
A mechanism needs to be found to promote stability and long-range direction of NIST's budget. (pg. 7)	NIST encourages and benefits greatly from the VCAT's recognition of NIST's resource needs, acknowledgement of the value of long-term stability for research-intensive programs, and expression of its views about the economic and societal benefits of adequate support for NIST's programs.

Source: Prepared by NIST and distributed to the VCAT, Sept.14, 2004.
Note: Page numbers refer to the FY 2003 VCAT Annual Report.

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