

VISITING COMMITTEE ON ADVANCED TECHNOLOGY
National Institute of Standards and Technology

FY 2006 Annual Report

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

VISITING COMMITTEE ON ADVANCED TECHNOLOGY

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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 NIST, its organization, its budget and its programs within the framework of applicable national policies as set forth by the president and the Congress. This fiscal year 2006 annual report covers the December 2005 (FY2006 Quarter 1) meeting through the September 2006 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 US science and technology base and to the economy. Over the past year, the Committee has been active in assessing NIST's progress in the following:

- Strategic direction and performance
- Infrastructure and process in support of strategic needs
- Outreach - Assessing and responding to external drivers
- Organizing and executing with excellence

Throughout the year, the Committee seeks to cover a significant portion of NIST programs through direct discussion with NIST leaders, scientists and engineers. Reactions and observations are discussed candidly with the NIST representatives and other guests at each meeting. This feedback is used to seed continuous improvement in key areas in the overall operation. At each quarterly meeting, the Committee also visits various NIST laboratories and discusses the research projects directly with the technical staff. These laboratory tours help the committee assess NIST's progress vs. strategic plan and NIST infrastructure.

Members of the Committee have careers in industry and in academia, and are selected solely on the basis of established records of distinguished service and eminence in their fields: research, engineering, business and other fields relevant to the NIST 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 US industries. Two new members joined the Committee during 2006: Dr. Thomas Baer and Dr. Paul Fleury.

One of the more important developments for FY2006 was the development of the American Competitiveness Initiative. The resulting budget increases for NIST are noteworthy, and need to continue in a manner that supports the appropriate strengthening of key areas.

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.

Members of VCAT:

Ms. Deborah L. Grubbe, P.E., Chair BP International	Mr. Gary D. Floss Marvin Windows and Doors
Dr. Thomas M. Baer Stanford University	Dr. Lou Ann Heimbrook Merck & Co., Inc.
Dr. John F. Cassidy United Technologies Corporation (retired)	Dr. Donald B. Keck Corning Incorporated (retired)
Dr. Paul A. Fleury Yale University	Mr. Edward J. Noha CAN Financial Corporation
Mr. Thomas A. Saponas Agilent Technologies (retired)	Dr. E. David Spong, VCAT Vice Chair Boeing Company (retired)
Dr. James W. Serum SciTek Ventures	Mr. Robert T. Williams Caterpillar, Inc.
Mr. W. Wyatt Starnes SignaCert, Inc.	

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FINDINGS and RECOMMENDATIONS

The VCAT thanks Dr. William Jeffrey for his efforts to elevate and to educate others on the key role of NIST in a vibrant and growing US economy. In his first full year of operation, Dr. Jeffrey has broadened the impact of NIST across key areas of need (homeland security, nanotechnology, biosciences) and has supported more outreach internationally.

The VCAT would also like to recognize and thank Dr. Hratch Semerjian, as he moves from NIST Deputy Director to Chief Scientist. Dr. Semerjian's consummate professionalism and credibility enabled a successful transition for Dr. Jeffrey and for the NIST Staff.

On the matter of world renowned professional accomplishments, the Committee would like to offer its congratulations to Dr. John L. (Jan) Hall of NIST Boulder/JILA, for being awarded the 2005 Nobel Prize in Physics. Dr. Hall was awarded the prize for his contributions to the development of laser-based precision spectroscopy, including the optical frequency comb technique. Outstanding research attracts world class researchers, and this is a NIST competitive advantage that must be retained.

With a high quality portfolio of programs, NIST remains uniquely positioned to promote U.S. innovation and industrial competitiveness. Its advancement of measurement science, standards and technology are exemplar in today's world, and must be continuously nurtured. NIST programs consist of the following:

NIST Laboratories: providing measurements and standards for U.S. industry in these areas

- Building and fire research
- Chemical science and technology
- Electronics and electrical engineering
- Information technology
- Manufacturing engineering
- Materials science and engineering
- Physics
- Technology services

Baldrige National Quality Program: promoting and recognizing organizational performance excellence.

Hollings Manufacturing Extension Partnership: providing technical and business assistance to smaller manufacturers.

Advanced Technology Program: partnering with the private-sector to develop broadly beneficial technologies. (This program is currently being phased out.)

The Committee continues to believe that NIST's measurement science, standards and technology underlie the nation's technological and scientific infrastructure. Furthermore, as markets become more global and as global supply chains grow in number and in complexity, it becomes even more important that NIST maintains its leadership role in promoting more open and fair international dialogue on key measurement issues. US dominance in key industries, notably telecommunications and bioscience, could be at stake if this leadership is lost.

The American Competitiveness Initiative represents a total of \$1.3 billion in new Federal funding and an additional \$4.6 billion in R&D Tax incentives. Specifically, the ACI doubles over 10 years, the funding for innovation enabling research at three key Federal agencies, including NIST. This year NIST saw a significant increase to its Laboratory funding. This increase follows years of

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tight and declining budgets, and the committee is supportive of the Federal action, and supports future appropriations in line with the original ACI commitment.

The Committee is concerned about the continued downward pressure on MEP and ATP funding, as NIST also has a key role in supporting the existing industrial base. Good technology ideas are only sustainable if they can be turned into profitable businesses. Currently, ATP fills a niche very helpful to the successful development of new commercial technologies, and MEP facilitates the transferring of new industrial technologies and processes to small and mid size firms. It is the view of this committee that the US Government is perceived to be reducing its investment in the front end of the commercialization process of new technologies, and may want to consider NIST in a bridging role. In the future, this niche could be filled by more robust venture capital mechanisms in the private sector; however, stable mechanisms do not currently exist, access is difficult, and a systemic approach is indicated.

Lastly, in FY 2006, the National Research Council completed its bi-annual independent peer review of NIST. The VCAT appreciates the additional effort and time that the NRC takes in communicating its observations and results, and finds their insights quite helpful and supportive.

Strategic direction and performance

Finding: NIST has been receptive to the Committee's guidance on strategic planning, especially in the areas of:

- ***developing more strategic partnerships and collaborations,***
- ***accelerating interdisciplinary efforts into newer research areas,***
- ***establishing mechanisms to support its role in measurement science, and***
- ***Supporting key national priorities, e.g. Homeland Security.***

Recommendations:

1. The Committee supports the addition of a national priorities element to the NIST strategic plan. Recent work has shown that NIST has expertise to help improve the nation's economic recovery from both natural and man made disasters. For example, in addition to work with the Department of Homeland Security on threat detection and measurement, NIST is now supporting Hurricane Katrina clean up efforts with FEMA and NOAA. NIST is also supporting a Presidential initiative to develop a National Healthcare Information Network with the Department of Health and Human Services. In execution, the NIST senior leadership must work together to achieve the right balance of short term and long term effort.
2. NIST has done work this year to strengthen and to improve its research into the frontier areas of nanotechnologies and biosciences, and this work must continue. The establishment of the concept of the NIST Center for Nanoscale Science and Technology (NCST) is a very important accomplishment. The committee encourages NIST to complete the concept development and to ensure funding as soon as practical. Defining what success looks like at the outset will be one key to an effective overall effort.
3. The Committee spent a large portion of one meeting addressing NIST's role in the biosciences, and encourages NIST to carefully select its fundamental work based on what will be important to the future of this overall technology. For example, NIST could have a major impact on innovation in healthcare through support of measurement science for overcoming barriers related to cancer screening and diagnosis.

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4. The VCAT encourages NIST to continue to address the need for the US Measurement System (USMS) Effort. While substantial progress has been made in the past year with an assessment of 728 measurement needs and an interim report, it is critical to fit the whole USMS into a robust management system to ensure “fit for purpose.”
5. Each operating unit of NIST currently manages its own strategic planning process. While the committee understands the different nature of the laboratories’ place in the overall value chain, the committee encourages NIST senior leadership to develop a methodology to assess these various planning processes for completeness and relevance to the overall NIST mission. The committee suggests that actions be taken where needed to strengthen the analysis and the benchmarking aspects.
6. As the Committee looks forward, there are a few topics looming that may benefit from having NIST attention: sustainability, alternative energy and global warming. All three areas hold potential opportunity for US business and economic health. The Committee commends NIST for their current activity in transportation energy arena, and suggests a potential review for broadening.
7. NIST has historically had tremendous expertise in Information Technology (IT). This has traditionally included software quality, cryptography and applied IT security methods. Also, NIST has been tasked with new IT related methods relating to the Help America Vote Act (HAVA). As IT is increasingly crucial to nearly all sectors of the US economy, the committee recommends that the Director and staff take a renewed look at the strategic opportunities for NIST to assert its IT expertise, especially in emerging areas such as Trust-Based computing (which is the backbone of HAVA) and where commercial standards are just emerging. Future benefits could be in the form of better best practices and methods for both industry and government users, e.g. FISMA or Common Criteria.

Infrastructure and process in support of strategic needs

Finding: NIST has made substantial progress in the area of improving infrastructure to support the strategic direction. Key areas of accomplishment include:

- ***New and improved physical facilities at both Gaithersburg and Boulder***
- ***Shifting VCAT processes to focus on strategic needs***
- ***Establishing methodologies to leverage similar research activities with non governmental bodies external to NIST***

Recommendations:

8. NIST has done a good job improving the physical facilities at its Boulder and Gaithersburg campuses. There is more work to be done, and ongoing attention to upcoming capital requirements is indicated. The VCAT recommends that the ongoing review of the existing Gaithersburg infrastructure be updated annually for relevance and fitness.
9. The Committee spent a large portion of two meetings addressing NIST’s role in the biosciences, and is pleased to see expanding expertise in its own ranks in this key subject area. It will be critical in the future to have VCAT expertise across the breadth of NIST activities and needs, and the NIST Director is asked to ensure a full complement of VCAT membership.

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10. With the new interdependencies required of the OU directors, the VCAT has been pleased to provide input to NIST in the form of two discussion panels over the past year. The topics were: “Best Practices for Strategic Planning: Lessons Learned from Managing Organizations with Multiple Business Units and Customer Bases,” and “How to Maximize NIST Impact on US Innovation.” The committee encourages that agenda time be spent periodically in this kind of dialogue. Senior NIST staff obviously valued and derived benefit from this form of benchmarking.
11. NIST continues to reach out to other non-government entities for collaboration. The committee is very supportive of this approach and is heartened by some key activities this year that included exploring how best to support a state funded nanotechnology center, and identifying new ways to help small manufacturers to be more competitive. The Committee recommends that NIST do an analysis of its non governmental partnerships to date, and seek understanding and learning from those that are no longer functioning well.

Outreach -- Assessing and responding to external drivers

Finding: NIST has been very active in responding to external drivers, especially in the following areas:

- ***Natural disasters and emergencies***
- ***Opportunities presented in the form of Executive branch and Congressional actions***
- ***Global dynamics for measurement science***

Recommendations:

12. The Committee applauds the efforts of NIST to support key national needs like hurricane relief support. The needs are obviously acute, and NIST has a strong contribution to make with its expertise. NIST involvement and the resulting publicity will aid in the education of the public as to NIST’s potential capabilities and to the skills that are resident within NIST. The Committee recommends that NIST continue to look for and to investigate ways to leverage itself with specialized contractor partners, with the goal of perhaps developing other service delivery mechanisms to prevent from efforts becoming too diluted.
13. The NIST leadership is to be commended for their outreach to others in Federal, State, and Local Governments. The list of interactions with the White House, other Executive Branch agencies, and the US Congress is impressive. However, more work needs to be done. For example, the VCAT encourages NIST to be proactive in its partnership with NCI and NIH related to measurements in the biological sciences. Better efficiencies and outcomes in healthcare, and potentially lower healthcare costs, are a potential result. Most outreach has been frequent, relevant and mutually supportive of NIST growth. Some examples include:
 - a. Many governmental leaders visited NIST facilities in FY2006
 - b. NIST Director testified at a joint hearing held by the House Committee on Science and the Committee on House Administration regarding voting machine standards
 - c. Ensuring that NIST is one of the 3 key agencies mentioned in the ACI.
14. While there has been much discussion about the role of international measurement and standards bodies in the future of NIST, the committee recommends that the NIST Director commission a formalized initiative to outline, to investigate and to

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execute an in depth analysis of the other global bodies that are currently undertaking NIST like activities. Items to be considered could look like, but not necessarily be limited to the following:

- a. Nations that could pose a threat to NIST dominance
- b. Models of more effective government, academic, and industrial collaboration, and their key elements of differentiation
- c. The role of centralized government planning and stated national initiatives, e.g. Singapore and biotech research
- d. Potential collaboration with the National Science Foundation around the educational dynamics of the developing world, knowing that the planning horizon for this activity will far exceed the timeline for any planning activity within a NIST operating unit.
- e. Engagement with multinationals from all regions on how they see measurement science affecting their business

Organizational Excellence

Finding: While the NIST Director has focused the VCAT on strategic needs for FY2006, the VCAT charter also involves making clear recommendations regarding general policy and organization. Our time was limited in this area; however, we have two findings.

- ***Emphasis on safety as an indicator of organizational health***
- ***Continuous improvement as an organizational value***

Recommendations:

15. NIST has made solid improvements over the years to improve its laboratory safety. There is an active safety committee and a yearly safety day is held to encourage workforce awareness and participation. However, there are still inconsistencies in application of safety procedures across the laboratories. Safety is a leadership activity that the senior NIST leadership must be actively involved in. The Committee believes that attention to and excellence in safety can bring benefits in ensuring the ongoing safety and health of the workforce, which could mean the difference in completing some key research initiatives on time and within budget. Good safety practices on the road also ensure that personnel are not injured or lost during special operations like hurricane or terrorism relief efforts. Impressing industrial visitors in this area will add credibility to NIST and to its mission, as many potential partners work in industries where application is tighter.
16. NIST has done an outstanding job leading and managing the Baldrige National Quality Program. The Committee recommends that NIST take two actions with respect to the Baldrige effort. First, NIST internally embrace the Baldrige spirit of continuous improvement and discipline, as a matter of "practicing what one preaches." Secondly, that NIST commission a special study into the general business condition of Baldrige awardees at the 5, 10 and 15 year levels from their award. The root causes of such a study can be used to improve the program, as it would be looking at outcomes over time. Such a study could be very supportive of the overall notion of the American Competitiveness Initiative, but from a different viewpoint.