

## 2002 Annual Report

# THE NIST VISITING COMMITTEE ON ADVANCED TECHNOLOGY



U.S. DEPARTMENT OF COMMERCE  
TECHNOLOGY ADMINISTRATION  
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY  
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# Preface

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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 2002 annual report covers the December 2001 meeting through the September 2002 meeting.

The Committee studies the allocation of resources employed to achieve NIST's mission as well as the policies and processes employed by NIST management to optimize the overall effectiveness of the Institute's programs. Over time, the Committee seeks to cover the full spectrum of activity at NIST. In addition to direct discussion with NIST leaders and professionals, the committee reviews reports from the National Research Council Board of Assessment (of the technical excellence of NIST's programs), the Manufacturing Extension Partnership Program (MEP) National Advisory Board, and the Advanced Technology Program (ATP) Advisory Committee. In light of the broad experience represented by the VCAT and the other Boards, this approach delivers a reliable overview of NIST. Reactions and observations are discussed candidly with the NIST representatives involved at each meeting. This feedback is positively received, and we see much evidence of constructive response to it.

Members of the Committee are selected on the basis of their backgrounds and experience and are appointed by the NIST Director to staggered 3-year terms. Three new members joined the Committee during 2002, Mr. Gary Floss, Dr. Richard Gross, and Dr. Jenny Hunter-Cevera.

## 2002 Visiting Committee Members



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DR. JENNIE C.  
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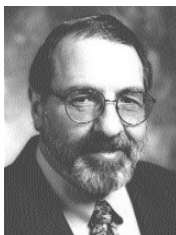
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Council for Chemical Research



WAYNE H. PITCHER, JR.  
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3-Dimensional Pharmaceuticals, Inc.



DR. APRIL M. SCHWEIGHART  
Product Business Manager  
Motorola



MASAYOSHI TOMIZUKA  
Director, Engineering Systems  
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# I. Executive Summary

The NIST Visiting Committee on Advanced Technology (VCAT) reviews and makes recommendations regarding general policy for the National Institute of Standards and Technology (NIST), its organization, its budget, and its programs, within the framework of applicable national policies as set forth by the President and the Congress. We present our findings in this annual report to the Secretary of Commerce for submission to the Congress.

The VCAT is convinced of the great current value provided by NIST to its sponsors and constituencies. The Committee is gratified that NIST is evolving to higher levels of performance, consistent with past Committee recommendations. Particularly noteworthy accomplishments this year are:

- the development of a meaningful Strategic Plan process that cuts across the existing organizational boundaries,
- providing an appropriate and rapid response to the 2001 terrorist attacks, effectively marshalling many of NIST's varied competencies and redirecting resources internally as necessary,
- fostering an environment that encourages excellence in science as evidenced by the award of the 2001 Nobel Prize in physics to Eric Cornell et al.,

the second Nobel Prize for NIST staff since 1997.

However, the increasing interdisciplinary nature of R&D, and increasingly globally distributed nature of R&D networks and organizations, creates an environment in which NIST must become even more flexible in developing new competencies and shifting resources to meet emerging opportunities. In light of these factors the VCAT offers the following conclusions and recommendations:

- Several funding issues are alarming. The increasing shortfall in research funding, the additional budgetary burdens resulting from unfunded mandates, the lack of adequate funding for equipment for the Advanced Measurement Laboratory, and the necessity of deferring maintenance are critical situations. It is imperative that NIST be adequately funded to be able to meet national needs and continue to provide excellent service to the Nation with its research.
- NIST must now quickly move to implement the strategic plan at the Operating Unit level, providing more detail on reprogramming efforts and what specific research programs will support higher-level plan goals, consistent with customer needs. NIST must continue the process it has started—to

develop a method for managing resources on a NIST-wide basis.

- Performance metrics should be developed for the organization and its portfolio of projects. A cascading set of metrics with intermediate milestones and leading indicators should be developed to integrate individual and project objectives with overall goals. The development of effective performance metrics will be an iterative process, and NIST should continuously review the effectiveness of its metrics, concentrating on the useful ones and replacing the less effective ones.
- Additional collaborations with industry, academia, and other Federal agencies are encouraged to leverage NIST contributions within a limited budget and to increase responsiveness to customer needs. Successful NIST collaborations through the Center for Advanced Research in Biotechnology (CARB) and JILA demonstrate the value of this approach.

These and related points are discussed in more detail in Section II. Section III summarizes and consolidates the information from NIST presentations to the Committee. Further details can be found on the VCAT Web site: <http://www.nist.gov/director/vcat/>.



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*New methods for analyzing degraded DNA tissue samples developed by NIST chemists are helping to identify victims of the World Trade Center disaster.*

## II. Discussion of Key Issues

The VCAT again finds NIST to be a significant national asset that is recognized as the world's leading measurement and standards organization. NIST provides irreplaceable services to U.S. business and industry by underpinning our measurements and standards infrastructure. This role is indispensable to maintaining and enhancing productivity and competitiveness; enabling international trade; and improving public health, safety, and environmental quality. However, the Committee can best provide value to NIST and its stakeholders by focusing on areas where NIST can improve, rather than celebrating at length the recognized technical excellence of NIST.

This year the Committee focused primarily on the development of the NIST strategic plan. This is a critical step in making NIST more responsive to a changing technology environment in the face of constrained budgets. Issues and recommendations that the Committee views as important to NIST were discussed thoroughly with NIST management at the quarterly meetings, and the results of those discussions are presented in this section.

### A. Budget

The immediate funding situation with regard to NIST research and its facilities is alarming. The Committee is concerned about the increasing shortfall in research funding resulting from inadequate adjustment-to-base funding to cover

increased research costs and the additional budgetary burdens resulting from mandatory salary and benefit increases without sufficient funding. While the VCAT sees evidence of significant expense reductions, research costs have



*NIST's Advanced Measurement Laboratory, now under construction, will be one of the most advanced research buildings in the world when occupied in 2004.*

increased at a significantly higher rate than the inflation-adjusted funding increases. Further, chronic underfunding of the Safety, Capacity, Maintenance, and Major Repair (SCMMR) budget has resulted in a deferred backlog of safety and maintenance upgrades that will predictably lead to serious interruptions of NIST's research and expose staff to increased safety risks through failure of aging roofs, heating plants, and electrical switchgear. Finally, the Advanced Measurements Laboratory (AML) will be unique in the world and is expected to play an important role in accelerating the transition to the commercial sector of many techno-

logical innovations emerging from the Nation’s research investment. It is imperative to our industrial competitiveness that the AML be fully equipped as initially planned.

As a result of these concerns, the Committee has written a letter to the Secretary of Commerce to increase his awareness of these critical budgetary needs related to the maintenance and operation of NIST’s facilities and research. The VCAT sees the proper funding of NIST as an issue of critical importance to the long-term health of the organization and to its ability to continue to provide excellent service to the Nation. The VCAT intends to review the long-term budget issue in more detail in future meetings and to define an appropriate role for the Committee to help improve NIST’s budget situation.

The A-76 commercial activity outsourcing assessment that NIST is beginning to undertake is an excellent opportunity for NIST to go beyond the mandate and actively seek additional efficiencies and cost savings. The Committee has offered to apply its expertise in helping NIST with this matter.

**B. NIST 2010 Strategic Plan—  
General Comments**

The Committee commends the NIST management in bringing the NIST 2010 Strategic Plan together and, more importantly, in develop-

ing a thinking process that cuts across the existing organizational boundaries. This plan articulates very well the mission, vision, and goals of NIST. It is a necessary step to permit NIST to strike a balance between new activities and industries and traditional activities. NIST correctly recognizes that the strategic planning process is just that, a continuing process that does not end with the production of a strategic plan.

Future NIST appropriations will be made in a climate of constrained Federal budgets. This will produce greater challenges for the organization to meet its current obligations to its stakeholders, while developing new programs to meet changing national needs and priorities. Programs should respond to the outside world rather than conform to the internal structure. NIST must now quickly move to implement the strategic plan at the Operating Unit level, providing more detail on reprogramming efforts and what specific research programs will support higher-level plan goals, consistent with customer needs.

**C. Strategic Plan  
Programmatic Goals and  
Strategies**

The specific focus areas chosen are appropriate for NIST. However, the rationale for selection of the research initiatives and how much the choices were

driven by external customer interests is not yet clear. The programmatic Strategic Focus Areas (SFAs) are appropriately intended to consolidate work across Operating Units. Yet there continues to be important existing core-competency work not directly related to one of the programmatic SFAs. NIST needs to include in the strategic plan, and show that it values, this core work that is not directly covered by the SFAs.

**Table 1 - NIST-Wide Strategic Focus Areas (SFAs)**

**Programmatic SFAs**

- Homeland Security
- Health Care
- Information/Knowledge Management
- Nanotechnology

**Organizational SFAs**

- Customer Focus
- People
- IT Infrastructure

In particular, two focus areas engendered some discussion within the Committee. Nanotechnology is perceived as a very broad area in which industry and academia are already actively involved. Thus, the Committee recommends that NIST discriminate clearly its planned focus and expected contributions. Likewise, the Committee recognized the research focus on Interoperability for Collaboration and Testing



(within the Information/ Knowledge Management SFA) to be very broad. The VCAT again recommends that NIST's work in this area be more narrowly defined with a higher degree of specificity. This improved focus should help increase NIST's impact in the area and facilitate the development of appropriate performance measures.

NIST demonstrated valuable technical responses to the September 11 attacks. This case demonstrates how the existence of a broad spectrum of previously nurtured technical competencies can enable a meaningful response to emergent needs. A greater NIST role in the areas of building construction and safety, such as being a strong advocate for improving building codes, would be beneficial here, and we support efforts to find more resources for it. This case also points out the need for, and the importance of, a system for rapidly re-deploying resources on a NIST-wide basis. As yet, NIST does not have needed mechanisms in place to permit managing resources across Operating Units.

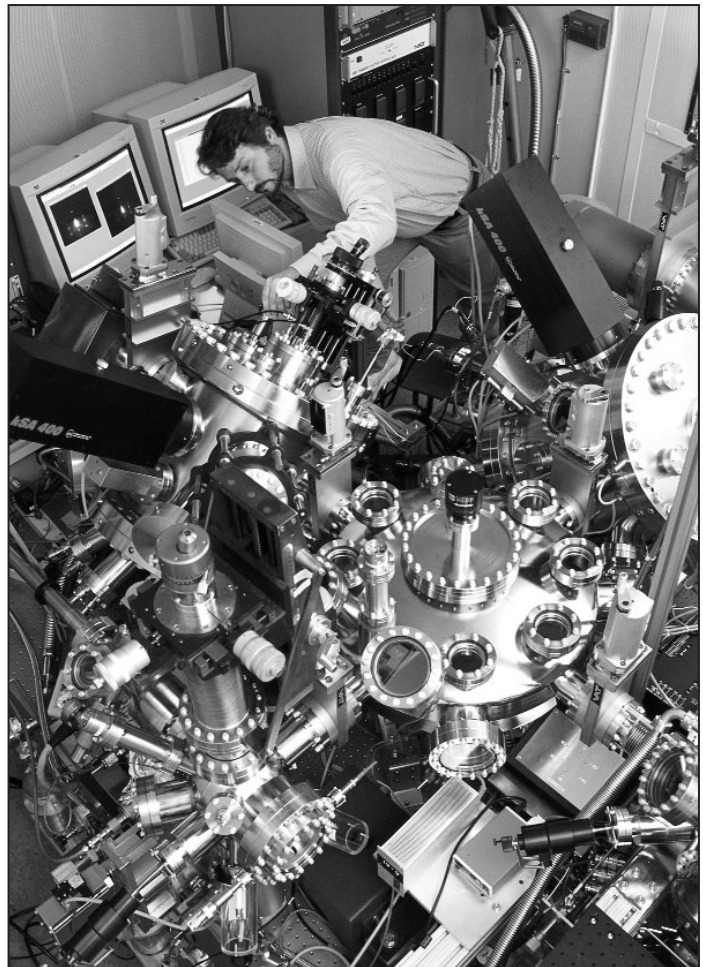
#### **D. Organization Values and Goals**

NIST has made significant and measurable progress in establishing the right conceptual framework to achieve diversity. The actual implementation of the program will require some degree of cultural change, as well as a

concerted effort by upper management to clearly demonstrate the practical benefits to NIST of a well-balanced work force. NIST must apply the diversity principles that it has developed to the hiring of personnel at the highest levels in the organization.

Although the safety record of NIST is good when compared to similar organizations, NIST must continue to develop a widespread and naturally accepted safety culture throughout the organization. NIST management understands clearly the steps that must be taken.

A more highly centralized and controlled Information Technology (IT) system would offer NIST increased productivity and efficiency. Plans to move in this direction are underway, and the Committee urges NIST to move forward as rapidly as possible.



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*NIST physicists use a room-sized instrument that produces ultra cold temperatures and ultra high vacuum to measure electronic and magnetic properties within nanostructures on an atom-by-atom basis.*

## **E. Performance Metrics**

The Committee recognizes that selection of appropriate performance measures is critical to the execution of the NIST strategic plan. Such measures will also be critical to demonstrate the value of the organization to its constituencies and stakeholders. The Committee scheduled working sessions with NIST management to assist them in the challenging task of developing and fine-tuning such performance measures. At present, NIST's evaluation plan depends on external peer assessment, quantitative output metrics, customer satisfaction data, and economic impact studies. The Senior Management Board is focusing on the correct issues related to performance, diversity, and metrics (the balanced scorecard).

The Committee recommends that performance metrics should be developed for the organization as a whole, for the portfolio of its projects. A cascading set of metrics with a focus on some intermediate milestones, and some leading indicators, should be developed for programs within the portfolio. The criteria that drive the program prioritization process should be coordinated with the metrics. All employees ultimately need to be focused on a few important strategic objectives. The development of effective performance metrics will be an iterative process, and NIST must continuously review the effectiveness of

its metrics and replace those found to be less effective.

## **F. Collaborations, Strategic Partnerships, and Outreach**

NIST effectively reaches out to a variety of organizations at the bench level, and uses the news organizations to reach higher levels in organizations. The NIST Director has been particularly effective in interacting with Congress to increase their awareness of opportunities where NIST can meet national needs. Such efforts will be beneficial in the long term. NIST also uses workshops, conducted under the Department of Commerce Technology Administration, to reach leaders from industry, university presidents, and directors of national laboratories. Improved collaborations with these organizations are critical to enhancing NIST's ability to carry out its mission in a climate of flat or declining budgets.

The Committee recommends that, as a first step, NIST develop a partnership model with an estimate of benefits that accrue to all the collaborators. Even more, and stronger, collaborations with industry, academia, and other Federal agencies are encouraged. JILA and the Center for Advanced Research in Biotechnology (CARB) are two outstanding examples of the success of this tactic. Possible problems with intellectual property rights and

issues of proprietary research are routinely dealt with by public universities. We further recommend that NIST review such policies and procedures for application to their situation.

NIST also needs to strengthen further its connection with industry leaders and better focus its message to that audience. Measurements are such an integral part of science that there is a lack-of-awareness issue within industry as to the difficulty of such measurements and the need for NIST expertise.

## **G. Extramural Programs**

The renewed commitment to the Advanced Technology Program (ATP) is a positive sign, and the changes recommended by Secretary Evans will bring stability to a program of significant value to the Nation. In an environment of long-term financial stability and widespread support, NIST is uniquely qualified to lead the implementation of the program in a way that increases its impact.

NIST is to be commended for its visionary and proactive management of the National Quality Program (NQP). Efforts to expand participation of educational institutions are on target and should continue to be a priority area for the program. The dissemination of the principles behind the NQP to educational institutions is an area with great potential impact to the Nation.

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The significant reduction in funding for the Manufacturing Extension Partnership (MEP) program in the President's 2003 budget request is of concern to the Committee. The most likely

outcome of the elimination of Federal funding to the Centers will be the end of the program. This would be certainly an unfortunate development since MEP has been a strong, well-managed, and

clearly valuable program of broad impact. However, we also recognize that such funding decisions are being made in a context that transcends the preferences of NIST and/or the VCAT.

### III. Committee Review Activities

The Committee meets quarterly with NIST management and staff at NIST's Gaithersburg (March, June, December) and Boulder (September) locations. This year, in addition to formal presentations and laboratory tours, a series of interactive "working sessions" were held during which the VCAT provided further input and guidance to NIST management. These were useful, and the Committee expects to continue them at future meetings. The major points discussed at the meetings are summarized below. Additional information may be found in the meeting minutes on the VCAT Web site, <http://www.nist.gov/director/vcat/>.

#### **A. Preeminent Performance: The NIST 2010 Strategic Plan**

Preeminent Performance, the NIST 2010 Strategic Plan, is a long-term planning process. NIST is focused on developing the ongoing process, not just the plan itself. The goal is to 1) envision the Institute's future, 2) establish long-term goals, and 3) allow reprogramming of resources. Right now NIST is at the transition between steps 2 and 3. The current NIST budget request, for example, is a strong match to the strategic focus areas.

The plan describes the NIST mission and core values, covers all of NIST, and focuses on NIST-wide opportunities. It provides an integrated planning process, is

designed to be dynamic, and will provide the basis for the Operating Unit (OU) plans. The title "Preeminent Performance" was chosen to indicate that the plan:

- is responsive to the President's management agenda,
- identifies areas where NIST has unique value,
- is responsive to national needs through service to industry and other agencies,
- provides for prominent participation in national and global science and technology, and
- demands accountability to NIST's external stakeholders and to itself.

The VCAT was provided with draft copies of the plan and asked by NIST to comment specifically on 1) whether the case for NIST is compelling, i.e., is it clear what problems are being solved and if NIST is the appropriate agency and has sufficient resources to pursue these problems, 2) recommended strategies for communication of the plan to NIST stakeholders, and 3) whether the anticipated impacts of this work are well specified and whether there are mechanisms in place to properly evaluate the success of the work. Several sessions were held during the quarterly meetings to discuss these issues among the Committee members and provide suggestions to NIST management.

The plan identifies seven Strategic Focus Areas (SFAs) (see Table 1, page 4). Four are in programmatic

(technical) areas, where advances in technology require improved measurement expertise, and three are in organizational areas that form the foundation of NIST's organizational performance. The SFAs were developed through offsite meetings and focus group sessions. The areas were chosen based on their greatest potential for future impact. All these areas will require collaboration across multiple OUs. To accomplish its goals NIST will require new and stronger internal and external partnerships. The strategic focus areas are intended to consolidate work across Operating Units. There will continue to be a large amount of core-competency work not directly related to one of the four programmatic strategic focus areas. NIST now needs to include in the strategic plan this work not directly covered by the strategic focus areas. The VCAT was briefed on the research goals, technology environment, and expected impact of planned NIST work for most of the SFAs.

#### **B. Programmatic Strategic Focus Areas**

##### *Health Care*

Health Care is a large element of the economy, and U.S. companies are leaders in this industry worldwide. Research and commercial development are now outpacing improvements in measurement infrastructure. This typically happens in R&D areas,

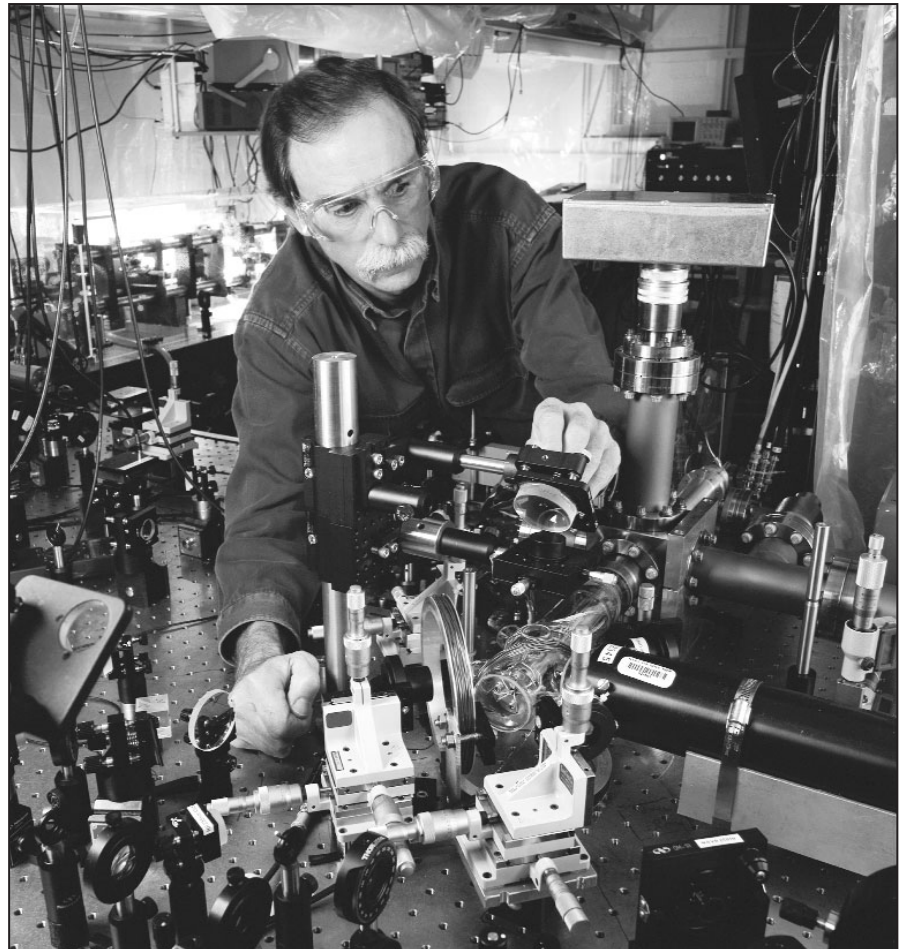
but in health care it is impeding the implementation of new findings to the people who need them. There is a need for improved measurements right now.

To help U.S. industry develop and apply technology, measurements, and standards, NIST first identifies specific needs that are appropriate to its expertise. One such area is clinical diagnostics. The next generation of diagnostics, array-based diagnostics, where one is looking for patterns of markers, is complex. The quality of these arrays is now largely suspect. Whole clinical trials have been declared useless because of inadequate measurement control. Also needed are standards for interoperability and security of Information Technology systems, and impartial technical advice to industry groups and regulatory bodies. Regulatory agencies are currently questioning measurement results.

As a result of planned work, NIST anticipates faster and better regulatory decisions, faster introduction of new technologies, improved confidence in research and clinical conclusions, more efficient studies and diagnoses, better decisions throughout clinical practice, and better quality health care overall.

### *Information/Knowledge Management*

Information/Knowledge Management (IKM) is a very broad area that needs careful defi-



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inition. For the NIST strategic plan, IKM is viewed to include the future research and development needed for the general creation and sharing of knowledge.

The specific IKM thrust areas that NIST has identified as appropriate for them are: standards and performance metrics for integrating applications and systems, facilitating effective sharing and collaboration, and advancing critically evaluated data management technologies. NIST has developed white papers in these areas, and has surveyed industry and staff.

*A practical method for building a quantum computer has been proposed by NIST physicists. Computers based on the quantum properties of individual atoms may someday solve problems in seconds that would take months on today's best supercomputers.*

The response is positive—NIST can make important contributions in these infrastructural technologies. A National Research Council (NRC) workshop identified this as an important future environment for NIST.

The impact of NIST's work is expected to be broad based: improved R&D productivity, improved manufacturing productivity and reduced cycle time, improved health care quality, and enhanced general business productivity. Interoperability issues that are now dealt with by industry on a spot basis will be facilitated by performance metrics, tests, and standards. Economic impact studies of previous, related, efforts have indicated NIST's work has had significant impact—we expect that to be true for this effort also. This work also complements new Federal R&D investments in information exploitation for homeland security and fills a critical technology need in the Federal IT R&D portfolio.

#### *Nanotechnology*

NIST views nanotechnology as a future disruptive commercial technology. It has multi-sector impact, while innovation and commercialization are limited by an inadequate metrology infrastructure. NIST intends to achieve a technological advantage in nanotechnology by providing industry, government, and university research

efforts with nanoscale measurements and data capabilities that are unmatched in the world.

Immediate needs are for measurements, standards, and data to establish the accuracy and reliability of nanoscale measurements for materials characterization, e.g., for nanomagnetic memory and storage devices. Reproducible measurement techniques and uncertainty specifications for quantum computing and quantum electronic devices is a future need, but could potentially have the highest impact. Some of the tools used for quantum information, such as single photon sources and detectors, are also essential metrology tools in representing the Système International (SI) units and within the scope of NIST competencies.

As a result of this planned research, NIST expects: an accelerated development of innovative technologies through more efficient and productive R&D; an accelerated commercial development of nanomagnetic technologies and next-generation micro-electronic devices; and an accelerated development of nanoscale biomaterials and new health care technologies. These tasks will foster work in all of the NIST research laboratories.

Two specific, ongoing programs in nanotechnology were described to the Committee.

Moletronics (molecular electronics) is a new approach to electric circuits, finding molecules that perform electrical functions. Motivating this research is the increasing need to reduce device size. Molecules are potentially a good approach, as even big molecules are small. One can also control the electrical function through chemical synthesis, and molecules can be made to self-assemble. The role for NIST is to develop the measurement tools and data necessary to measure, model, and control the flow of charge through molecules and ensembles of molecules.

The second program, Single Molecule Manipulation and Measurement, is to develop and integrate new measurement methods to probe the structure, function, and dynamics of single biomolecules (DNA and RNA). Measurements must be made on single molecules as ensemble averaging obscures fine-grained detail produced by individual molecules. The NIST measurement challenge is to make complete structural and functional measurements on single molecules.

#### *Homeland Security*

The NIST goals for homeland security are to become the lead provider of measurement infrastructure, measures of system performance, and quality assurance for homeland security technolo-



The lead investigator for NIST's study of the World Trade Center buildings shows reporters where steel samples now under study at NIST stood in the building before its collapse.

gies. The objectives are to encourage adoption and use of NIST measurements and data to reduce vulnerability of critical systems; provide more effective deterrence against attacks; have safer, more effective, first responders; and field more cost-effective security measures.

The most effective role for NIST is to provide the measurements, standards, data, and more comprehensive advice needed by other agencies and the private sector to minimize cost-effectively the risk and consequences of future attacks. Some examples of recent work include: standards for airport security x-ray machines and metal detectors; new methods of detecting concealed weapons and threats; improved biometric identification technologies; improved

methods and standards for DNA analysis; new standards for ionizing radiation, first-ever protocols for irradiation of mail; and new standards for cyber encryption.

NIST has taken the lead to develop lessons learned from September 11 attacks, and to reduce the vulnerability of buildings and physical infrastructure to future terrorist attacks, of whatever sort. A response plan, which will be at least a three-year effort, has been developed to bring NIST's expertise in measurement and modeling together with the private sector. A great deal of information to improve building safety is already available, and more will be developed as the analysis of the World Trade Center proceeds. NIST sees a need for a National Construction Safety Board that functions in a manner similar to the way that the National Transportation Safety Board (NTSB) functions for the transportation industry. When building disasters occur, an independent, open investigation is needed to ensure that the knowledge gained is applied to building codes and practices.

NIST also successfully developed a protocol for the Postal Service for irradiating anthrax-contaminated mail. Millions of pieces of mail were contaminated as they moved through the Brentwood processing center. NIST modeling showed,

and its testing confirmed that an adequate dose could be provided using conventional medical treatment tools.

### **C. Organizational Strategic Focus Areas**

#### *Customer Focus*

NIST recognizes that customer focus is an important issue, where one should treat the customer as an appreciating asset. NIST's goal is to better understand customer needs and market trends, strengthen relationships with customers and stakeholders, and develop strategic partnerships. The Baldrige criteria were strongly considered while developing the key components of a customer-focused organization, and the impact of the program will be measured by the Baldrige criteria.

Anticipated impacts of the program are improvements in customer satisfaction levels, a continued and more systematic alignment of NIST work with customer needs, new and more productive relationships, increased stakeholder support, and continuous organizational improvement.

#### *People*

NIST is focusing on safety as part of its core values. The NIST Director, Deputy Director, and Operating Unit Directors meet regularly to plan and implement procedures to improve safety at NIST. From several internal

meetings, a safety action plan has been developed. Although measurement excellence is a pervasive value at NIST, up until now safety has not been a priority.

The NIST Diversity Advisory Board, an internal advisory committee with representatives from all OUs in NIST, is at work on a number of initiatives. Guiding principles are that leadership, accountability, and transformation are equally important when applied to people, as when applied to technical excellence. NIST has a keen awareness of all its responsibilities in managing its human resource capital. NIST intends to approach diversity in a broad and comprehensive way at the line management level, not managed from a single office or advisory board. The NIST strategic plan diversity goal is to foster an environment where core values include people who are respected, valued, and supported by each other in all their activities.

In addition to NIST's desire to manage its "human capital" effectively, NIST is also held accountable to the President's Management Agenda. The agenda is intended to make the Federal bureaucracy customer focused, results oriented, and open. To meet these objectives, NIST already has a fundamentally sound, mission-oriented organizational structure, and it has a good staff/manager ratio, particularly

when guest researchers are included. Long-term, NIST recognizes it must continue to attract and retain very high-quality technical and non-technical staff members, while general and specific workforce trends will significantly impact NIST's future organizational environment. The VCAT has offered to assist NIST in benchmarking its practices to other organizations, and identify what workplace trends may impact its markets.

#### *Information Technology (IT) Utilization at NIST*

NIST is working to build its infrastructure to support its current and anticipated interdisciplinary research structures. Its goal is to use information science and technology effectively and efficiently in creating, managing, and disseminating NIST's knowledge capital. In addition, NIST has some very significant business processes with specific constituents (ATP, MEP, grants management) that require secured, interactive processes to protect the proprietary information that is exchanged. This highly sensitive information also has specific archival requirements.

The present NIST computing and network environment includes a modest centralized scientific computing facility as well as 4750 PCs serving over 3500 users. Although there is some centralization of NIST IT services in the Information Technology



Laboratory, there is very significant “distributed computing” going on within the Operating Units. NIST management wants to consolidate all that activity into a single IT service in order to reduce costs. The present major centralized component consists of 120 people providing PC support, Web services, email server support, scientific computing support, software support, administrative and financial systems support, network operation support, telephone service, security operations, and physical plant operations. NIST will also re-evaluate its scientific computing environment. For example, there are heavy computational needs in chemistry, and also a need for distributed “cluster” configurations for the other laboratories.

#### **D. Reforms to Strengthen the Advanced Technology Program**

The Advanced Technology Program (ATP) accelerates the development of innovative technologies for broad national benefit through partnerships with the private sector. There has been some controversy over the life of the Program. NIST recognizes that it is important to build on the Program’s success while acknowledging valid criticism. The VCAT was briefed in some detail on reforms recommended by the Secretary of Commerce designed to strengthen the Program and stabilize its funding.



photo by Ron Bell

March 7, 2002, ceremony honoring the 2001 Malcolm Baldrige National Quality Award winners. (L to R) Commerce Secretary Donald Evans; Nathaniel Moore, student, Chugach School District; Richard DeLorenzo, superintendent of schools, Chugach School District; President Bush; Education Secretary Rod Paige.

**Reform 1** - Universities can lead joint ventures.

**Reform 2** - Universities and other non-profit organizations can own ATP-funded patents.

**Reform 3** - Large firms may participate in joint ventures.

**Reform 4** - Institute royalties on Government investments in profitable ATP joint ventures.

**Reform 5** - Ensure that ATP funding is used only to support removal of scientific or technology barriers.

**Reform 6** - Improve the project review and evaluation process.

The Program has also been under review by other entities, particularly the ATP Advisory Committee

and the National Research Council. Generally these external assessments conclude that the Program is doing well. The VCAT appreciates the emphasis of the ATP on joint ventures, as this is quite different from other Government programs, and serves well to distinguish the Program. However, if the Program is going to be effective it must come to grips with the issue of funding stability. These reforms are a positive effort to bring such needed stability to the Program.

#### **E. Baldrige National Quality Program**

The Baldrige National Quality Program (BNQP) is a

public/private partnership. BNQP works with roughly 400 examiners who come from the private sector. A private foundation raises funds for the awards and manages the endowment, but has no part in making the awards, nor in funding the NIST office.

Reviewing application submissions from previous years, one notes submissions have generally been decreasing from a peak in 1991 that was created when Motorola required that all their suppliers apply for the Baldrige. However at that time there were 111 State and local applications, and in 2000 there were 800 to 1000 State and local applications.

NIST intends to increase the number of national Baldrige award applications through a marketing plan implementation and an education program. Although Baldrige is well known—for example, it is covered in virtually all MBA programs in the United States—State and local winner CEOs will be encouraged to apply for the national award. Current examiners can be the best advocates for the programs and will be provided with marketing information. Workshops and exhibits at conferences are planned, and a series of CEO information sheets have been distributed. Advertisements have also been placed in minority business publications and industry sectors that are typically underrepresented,

to encourage applications for the award and to seek examiners.

Plans are also underway to include a not-for-profit category in the 2004 cycle. With the inclusion of this last category the Program will cover the entire economy.

#### **F. Overview of NRC Board on Assessment FY2002 Evaluation of NIST Labs**

Dr. Capuano, Chair of the National Research Council/National Academies Board on assessment of NIST Programs, reviewed the Board's recent evaluation of NIST. The Board was asked to assess the NIST laboratory research programs on technical merit, effectiveness of execution, relevance to customer needs, and adequacy of facilities. The Assessment is distilled from the collected observations of 156 experts who serve on seven specialized panels. Panel members are appointed to three-year terms, and an appointment may be renewed once.

Dr. Capuano summarized some of the Board's findings for the VCAT (which are very briefly repeated here). Regarding technical merit, the quality of on-going work is high, with some of the work outstanding in its excellence. There is a good balance between basic research and efforts directed at specific applications. The flexibility to respond to unanticipated

needs is high. NIST is making steady progress on strategic planning. That focus has helped the Board to determine what to review. Competition from private industry for recruiting quality staff is lessening because of the economy. However, there are significant retirements expected, and NIST planning should begin to account for this.

Overall the level and quality of technical equipment is adequate, but not uniform across the organization. Budget is a problem, and the lack of equipment is seriously affecting the quality of the research in some areas. The Board sees some improvement in facilities, but substandard conditions still exist, particularly in Boulder, and these deficiencies hamper the efficiency of the work.

#### **G. Laboratory Tours**

To gain an appreciation of the technical excellence of NIST research, Committee members periodically visit laboratories that are related to technical presentations to the VCAT.

*Center for Neutron Research (NCNR)*, Dr. J. Michael Rowe, host — The NCNR is the Nation's premier neutron research facility, serving over 1700 research participants annually. Serving both NIST mission needs and the U.S. research community, the NCNR operates more than 20 neutron

beam instruments to provide a broad range of neutron diffraction and spectroscopy capability for measurements of materials properties at the atomic and molecular scale.

*JILA* — JILA is a joint research institute of the National Institute of Standards and Technology and the University of Colorado. Located on the main university campus in Boulder, CO, the Institute is a center for teaching and research in the areas of atomic, chemical, optical, laser, gravitational, and solar physics; semiconductors; precision measurement; astrophysics; and astronomy. The VCAT visited five technical areas.

- Laser Spectroscopy of Supersonically Cooled Plasmas, David J. Nesbitt
- Single Molecule Microscopy of Nanostructures and Biomolecules, David J. Nesbitt
- Single Biological Molecules with Nanometer Resolution, Thomas T. Perkins
- Ultrafast Physics and Optics, Steven T. Cundiff
- Bose-Einstein Condensation, Eric A. Cornell



photo by Robert Rath

*NCNR's Joe Dura uses neutron reflectometry to study thin films, grown by molecular beam epitaxy, without removing them from the chamber.*









