2011 Annual Report

Visiting Committee on Advanced Technology of the National Institute of Standards and Technology

U.S. Department of Commerce

March 9, 2012

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 and updated by the America COMPETES Act. The VCAT is a Federal Advisory Committee Act (FACA) committee and its charter includes reviewing and making recommendations regarding general policy for NIST, its organization, budget, and programs within the framework of applicable national policies as set forth by the president and the Congress. In addition, the America COMPETES Act calls for the VCAT to comment on NIST's three-year programmatic plan in its annual report to Congress. This 2011 annual report covers the period from the beginning of March 2011 through February 2012.

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's programs to the U.S. science and technology base and to the economy. At the first meeting of each year, the Director of NIST proposes areas of focus to the Committee and agreement is reached on a program for the year. Over the past year, the Committee has been active in assessing NIST's contributions to and progress in the following areas:

- NIST's Role in Advanced Manufacturing
- NIST's Role in the Wireless Innovation Initiative
- Update on Ongoing Programmatic and Operational Issues
- Strategic Planning and Performance
- Status of NIST Budget

The Committee reviews a significant portion of NIST programs through direct discussion with NIST leaders, scientists, and engineers. Reactions and observations of the Committee members are presented candidly to the NIST senior management and other attendees at each meeting. This feedback encourages scrutiny of and continuous improvement in key areas in the overall operation. The Committee also visits various NIST laboratories and satellite facilities to discuss research projects directly with the technical staff. These laboratory tours help the Committee to assess the impact of NIST research, determine progress towards meeting the goals of the research plan, assess the quality of the staff, and the efficacy of the facility infrastructure.

Under the Committee charter, the Director of NIST appoints the members of the Committee and the Committee is asked to make suggestions for possible new member consideration. Members are selected on a clear, standardized basis, in accordance with applicable Department of Commerce guidance. Members are selected solely on the basis of established records of distinguished service; provide representation of a cross-section of traditional and emerging U.S. industries; and are eminent in fields such as business, research, new product development, engineering, labor, education, management consulting, environment, and international relations. No employee of the Federal Government can serve as a member of the Committee. Members are appointed for staggered three-year terms.

Two new members were appointed during the period covered by this report: Dr. Karen Kerr (University of Southern California), and Dr. Roberto Padovani (Qualcomm).

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

VCAT Members during the Period Covered by this Report

Dr. Vinton G. Cerf, Chair Google	Dr. Alan I. Taub, Vice Chair General Motors
Dr. Thomas M. Baer Stanford University	Dr. Sujeet Chand Rockwell Automation
Dr. Uma Chowdhry DuPont	Dr. Paul A. Fleury Yale University
Dr. Tony Haymet Scripps Institution of Oceanography, UCSD	Dr. Karen Kerr University of Southern California
Dr. Shaygan Kheradpir Verizon Communications (2010) Barclays Bank (2011)	Dr. Pradeep Khosla Carnegie Mellon University
Dr. Michael A. McRobbie Indiana University	Dr. Roberto Padovani Qualcomm
Dr. Alton (Al) D. Romig, Jr. Sandia National Laboratories (2010) Lockheed Martin (2011)	Dr. Darlene J.S. Solomon Agilent Technologies

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1. VCAT Focus in 2011

In 2011, the VCAT focused its primary attention on NIST's role in two key administration priorities – advanced manufacturing and the President's Wireless Innovation Initiative. To address these issues, the VCAT in consultation with NIST Director established two subcommittees to develop specific recommendations in each of the subject areas. The respective charges to each subcommittee are provided below:

VCAT Subcommittee on Manufacturing – Alan Taub, Chair

NIST's Fiscal Year (FY) 2012 budget request had a strong focus on manufacturing with increases to manufacturing-oriented efforts in the labs, the Manufacturing Extension Partnership (MEP), the Technology Innovation Program (TIP), and with the creation of a new public private partnership program – the Advanced Manufacturing Technology Consortia (AMTech) program. In order for the VCAT to develop recommendations intended to ensure that the labs remain aligned with industry and best meet their needs, and to refine the role that the NIST laboratory programs have in regard to manufacturing the VCAT Subcommittee on Manufacturing was asked:

> 1) To make recommendations to position NIST to best respond to industry's needs and to increase NIST's stakeholders' and policy makers' understanding of the utility of NIST's programs related to manufacturing;
>
> 2) To explore the role of public-private partnerships in advanced manufacturing and make recommendations on the structure and role of the proposed new AMTech program within the framework of NIST's current legal authorities; and
>
> 3) To provide recommendations and input on the development of a Manufacturing Strategy for NIST.

VCAT Subcommittee on Public Safety Networks – Vinton Cerf, Chair

Included in the President's FY 2012 budget request was a broad multi-agency initiative focused on the development of a next-generation wireless public safety communication system for the United States. This multi-billion dollar effort is to be funded by expected proceeds from the auction of Federal spectrum that would provide $300 million to NIST over ten years to ensure that the needs of the Public Safety community are built into this next-generation communication system. The VCAT Subcommittee on Public Safety Networks was asked:

> 1) To make recommendations on desirable architectural elements of a next generation wireless communication network that address the needs of the public safety sector; and
>
> 2) To comment on and provide recommendations for establishing and structuring a NIST program in this area.

During and in-between formal VCAT meetings, these subcommittees held multiple meetings and teleconferences including meetings with numerous external stakeholders from government and industry in order to gather data and develop their initial recommendations for consideration by the full VCAT.

This 2011 VCAT Annual Report summarizes the work of these subcommittees and the recommendations that were ultimately adopted and issued by the VCAT in each of these two important areas. The report also provides our continued recommendations and comments about NIST's continued efforts in standards policy, progress surrounding previous recommendations for measurement services, safety, and the NIST reorganization as

well as the NIST budget, and the implication surrounding the termination of Federal Funding for TIP and the Baldrige Performance Excellence Program (BPEP).

2. NIST Role in Advanced Manufacturing

After consultation with Dr. Patrick Gallagher, the NIST Director, the VCAT formed a subcommittee to make recommendations to (1) position NIST to best respond to industry's needs and increase understanding of the important role NIST can and does play in manufacturing; (2) provide recommendations and input on a strategy for supporting advanced manufacturing at NIST; and (3) explore the role of public-private partnerships in advanced manufacturing and make recommendations on the structure of such a program.

2a The Structure and Role of AMTech

The Advanced Manufacturing Technology Consortia (AMTech) program is designed to fill a critical gap for early stage technology development by providing incentives and resources for the formation of industry-led consortia that will support basic and applied research on long-term, precompetitive and enabling technology development. AMTech is a new program proposed in the President's fiscal year 2013 budget. The AMTech program's vision is consistent with the findings and recommendations in a recent report[1] ("PCAST and PITAC Manufacturing Report") by the President's Council of Advisors on Science and Technology (PCAST) and the President's Innovation and Technology Advisory Committee (PITAC). The report emphasizes the critical importance of advanced manufacturing in driving knowledge production and innovation in the United States. The PCAST researched the current state of manufacturing and concluded that U.S. leadership in manufacturing is declining and that this is detrimental to the well-being of the Nation overall.

The AMTech-supported consortia should enable technology development and create the infrastructure necessary for more efficient transfer of technology into use. By convening key players across the entire innovation lifecycle, the AMTech consortia will work to eliminate critical barriers to innovation, increase the efficiency of domestic innovation efforts and collapse the time scale to deliver new products and services based on scientific and technological advances. This strategy has the potential to drive economic growth, enhance competitiveness and spur the creation of jobs in high-value sectors of the U.S. economy.

RECOMMENDATIONS:

- *The VCAT strongly endorses the AMTech program as a model public-private partnership program for supporting technological innovation and facilitating its deployment to support advanced manufacturing. The VCAT's full set of specific recommendations on this topic were presented to NIST in the paper entitled Recommended Design Principles for AMTech, which can be found at: (http://www.nist.gov/director/vcat/upload/VCAT-Mfg-Summary-Recommendations.pdf)*

[1] *Report to the President on Ensuring American Leadership in Advanced Manufacturing,* PCAST Report, June 2011,

2b The Role of NIST in the Administration's Manufacturing Strategy

The recent PCAST and PITAC Manufacturing Report emphasizes the critical importance of advanced manufacturing in driving knowledge production and innovation in the United States. Manufacturing companies in the U.S. are responsible for over two-thirds of the industrial research and development and employ the majority of domestic scientists and engineers.[2] Furthermore, manufacturing R&D is the dominant source of service-sector technologies,[3] hence its benefits reach beyond purely manufacturing.

A core element of the PCAST recommendations was the need for a more coordinated R&D effort in partnership with industry. Coordination is needed for public/private activity and NIST is a natural candidate for this role. NIST's mission to promote U. S. innovation and industrial competitiveness positions it to play a central role in the advancement of manufacturing within the Nation. NIST is the only agency with a broad mandate to support manufacturing. Other agencies that support manufacturing research, do so in a mission-centric vertical manner. NIST on the other hand plays a horizontal role in the manufacturing domain to broadly benefit the Nation's economic and social well-being.

NIST is structured to respond to the various needs of the U.S. manufacturers through its diverse portfolio. With its broad range of programs, NIST provides a wide set of products and services that can help U.S. manufacturers accelerate their research and development and provide the necessary momentum to turn their ideas into successful products. These programs are closely aligned to recommendations in the PCAST and PITAC report and places NIST uniquely among other federal agencies to address the challenges laid out in the report.

Specifically, the NIST laboratory programs conduct research that advances the nation's technology base and is needed by U.S. industry to continually improve products and services. Improvements in manufacturing process and product technology depend on NIST's fundamental scientific and engineering research to develop:

- The precise and accurate measurement methods and measurement standards needed to improve quality and reliability, and
- New technological processes by which such improved methods may be used in practice to improve manufacturing and to assist industry to transfer important laboratory discoveries into commercial products.

During the October 2011 VCAT meeting, the Subcommittee on Manufacturing was briefed on the NIST Laboratory Research Programs that support advanced manufacturing. Work across the Laboratories was presented in the following areas:

- Smart and Sustainable Manufacturing;
- Nanomanufacturing (including flexible electronics activities);
- Next-Generation Materials Measurements, Modeling, and Simulation;
- Support for Semiconductor Manufacturing (including Post-CMOS efforts); and
- Biomanufacturing

The VCAT supports and endorses the ongoing and planned work that was presented.

[2] Bureau of Economic Analysis, NSF and Wolfe 2009, as cited by Tassey.
[3] Gregory Tassey, "Rationales and Mechanisms for Revitalizing U.S. Manufacturing R&D Strategies," *Journal of Technology Transfer 35* (2010): 283-333.

OBSERVATIONS:

During the meeting, the VCAT Subcommittee on Manufacturing agreed to the following:

- The Subcommittee on Manufacturing strongly endorses NIST Laboratory Research Programs that will lead to enabling capabilities in advanced manufacturing across sectors.
- It is important that NIST laboratories increase resources focused on advanced manufacturing to better exploit them for maximum competitive advantage. Given the NIST charter, it is the agency best-positioned to support the U.S. advanced manufacturing agenda.
    - World-class measurements and standards are critical to enhancing U.S. manufacturing competitiveness.
    - The NIST Laboratories provide core capabilities, which impact all industries.
    - Focusing on the interfaces across industry sectors enhances the Nation's ability to innovate and be more competitive. NIST is uniquely positioned to recognize these interfaces and exploit them for maximum advantage.

RECOMMENDATIONS:

- *The VCAT encourages building on the recent progress through continued investment and expansion of NIST programs in these areas and the development of a more complete strategic plan to address needs in advanced manufacturing.*
- *With the new leadership role of Secretary Bryson within the Administration for the development of manufacturing policy, the VCAT recommends that NIST should be assigned the lead for coordination of interagency efforts targeting advanced manufacturing.*
- *With its industry focus and non-regulatory mission, NIST should be the primary interface point between the Federal government and the University and Industrial partners that comprise the Advanced Manufacturing Partnership.*
- *The VCAT supports the AMTech program, but the requested funding levels were inadequate for the program to fully accomplish its mission and goals. The VCAT recommends that AMTech be funded at a level that enables the program to have significant impact.*

3. NIST Role in the Wireless Innovation Initiative

In support of the Wireless Innovation Initiative and in collaboration with Aneesh Chopra, the United States Chief Technology Officer (USCTO), the NIST Director charged the VCAT with the task of developing a summary of desirable features that could be incorporated into the design of a national public safety communication system. To fulfill this charge the Subcommittee on Public Safety Networks has met in person, by phone and online, and hosted several public meetings on this subject in Philadelphia, Chicago, and elsewhere[4]. NIST also issued a request for information and comment on "Desirable Features of a Nationwide Public Safety Broadband Network."[5]

Based on these efforts and responses to its request for public comment, the subcommittee prepared a report entitled, "*Desirable Properties of a National Public Safety Communication System",* which was formally approved by the VCAT. The full report can be found at:
(http://www.nist.gov/director/vcat/upload/Desirable_Properties_of_a_National_PSN.pdf)

[4] August 10, 2011, w/APCO Meeting, Philadelphia, PA; September 7, 2011, w/SAFECOM meeting, Chicago, IL; VCAT meetings, June 7-8, 2011 and October 17-18, 2011, at Gaithersburg, MD.
[5] "Soliciting Input on Research and Development Priorities for Desirable Features of a Nationwide Public Safety Network," *Federal Register*/Vol. 76, No. 176, Monday, September 12, 2011; responses due by October 12, 2011. [Docket No. 110727437-1433-01]

OBSERVATIONS:

In broad terms, the Subcommittee undertook an assessment of the status and trends evident in the technology used in support of first responders and other public safety actors. It was immediately apparent that responses to emergencies vary widely in size, scope, nature and need for specialist intervention. Not surprisingly, this high variance induces a need for a very flexible, resilient and robust system of communication that, in this 21st Century, must provide for the transport of voice, video, and digital information of all sorts. The emergency services community has gauged that the wireless telecommunications industry is investing heavily in what is called "LTE" or Long-Term Evolution technology aimed at providing high speed, digital communication services. The devices used to support LTE are typically "smart phones" that are programmable and that can support myriad applications, many of which make use of Internet-based resources. While the commercial versions of these devices typically lack the kind of rugged implementation associated with emergency communications equipment, they point towards a future in which emergency responders have access to as much or more information and communication capacity than ordinary consumers do today.

The report outlines the potential for extending LTE systems to include so-called "talk around" or "peer-to-peer" functionality as well as "mesh networking" capability that would allow individual end-devices to act as store-and-forward relays to extend network connectivity at need. Internet-based technology is one avenue through which such extension may be obtained, as well as supporting all forms of digital information exchange, access to Internet-based information resources and non-traditional respondents, wherever situated. Backward compatibility with existing emergency communication systems and equipment was deemed important, as was cost, reliability and ease of use.

Security loomed large as an important goal, including the validation of equipment and individuals to access emergency communication facilities and information. The use of strong authentication methods was considered an important element in a credible design for future emergency communications services.

These and many other observations were offered and a list of desirable properties was prepared and elaborated. The conclusions of this report are reproduced below and have been endorsed by the VCAT.

RECOMMENDATIONS:

- *A Public Safety Capability organization should be selected or created to orchestrate the detailed design, development and coordinated operation of a new, national public safety communication system. It should include a Public Safety Interoperability Panel to spur standards development and a resource management capability.*
- *The architecture of the new public safety network should:*
  - *Incorporate commercial technology where appropriate.*
  - *Extend commercial technology to achieve robustness.*
  - *Provide for backward compatibility or interoperability through standards adoption and/or development where feasible, including interoperation with existing and new 911 systems.*
  - *Give high priority to cost-effectiveness and affordability.*
  - *Take advantage of Internet and other packet-based technologies to support multi-media communication and mobile ad hoc network formation.*
  - *Incorporate assigned public safety spectrum and other data communication spectrum assignments and include opportunity for sharing where feasible.*
  - *Incorporate strong, federated authentication and other security technology to positively identify and authorize personnel and equipment permitted in the system.*
  - *Incorporate advanced position location capabilities, including indoor and underground location.*

- *Make extensive use of open national or international standards and, where appropriate, open source software.*

- *The development program should include substantial opportunity for coordinated development and testing of protocols, systems, devices and practices among a wide range of actors including traditional emergency responders, national homeland security elements, military, state militia, municipal, private sector public safety organizations and research agencies and institutions. Nontraditional players, including a wide range of private sector networked information industry elements, should be included.*
- *Persistent and sustainable test beds that accommodate urban, suburban and rural scenarios should be incorporated into the program in support of long-term evolution of public safety communication standards and technologies.*
- *Above all, the system must be flexible and adaptable to new requirements and incorporation of new technologies and capabilities.*

4. Update on Ongoing Programmatic and Operational Activities

This past year, the VCAT received updates on a number of major NIST efforts including standards policy, measurement services, safety, and progress on the NIST reorganization.

4a Standards Policy and NIST

2009 VCAT Recommendation: "*Serve as the principal inter-agency convener for documentary standards affecting national, international, and/or inter-agency interests by obtaining executive branch authority. The Department of Commerce (DOC) should sanction such a role for NIST where NIST would serve to coordinate the development of action plans and assure that overall architectural integrity of the standard is preserved. NIST would coordinate the application of expertise across relevant agencies.*"

RESPONSE: In 2009, the VCAT recommended that NIST assume a unique role in the federal government enterprise by serving as the principal inter-agency convener for documentary standards affecting national, international and/or inter-agency interests. In 2010, NIST assumed a major role in implementing this recommendation with NIST Director, Patrick Gallagher, designated as a co-chair of the National Science and Technology Council's (NSTC) Subcommittee on Standards (SoS). The SoS serves an important role in bringing together senior management from a cross-section of executive branch agencies and independent commissions, including the three offices within the Executive Office of the President – the Office of Science and Technology Policy, the Office of Management and Budget, and the Office of the U.S. Trade Representative. This varied representation is critical to developing positions and a shared understanding within the federal enterprise about the impact of standards on international competitiveness, technology, trade, intellectual property rights, etc.

In 2010, the SoS started to address the effectiveness of federal agencies' engagement on standards aimed at national priorities (e.g., development and deployment of an interoperable Smart Grid, secure and interoperable electronic health records, cybersecurity, etc.). Following a broad public stakeholder consultation throughout 2011, and discussions with numerous agencies, the SoS, in November 2011, released a set of policy recommendations to federal agencies to facilitate effective engagement to address national priorities through the use of standards.

The recommendations build upon existing statute and policy, and provide agencies with additional guidance on a number of current issues related to standardization. The policy recommendations balance the needs of the federal government with the interests of the private sector stakeholders in the U.S. model of public-private partnership for standardization. The policy recommendations have been well received by the U.S. private sector, which view the

policy recommendations as continued U.S. Government support for a public-private sector model of standards development. NIST's leadership in coordinating the development of this report is particularly noteworthy as it brought together a number of agencies that had previously focused primarily only on their specific interests relating to standardization. The development of the report provided a unique opportunity for agencies to explore standards related policy issues in a holistic manner, and develop principles that represent general consensus across agencies. Thus, the report also represents current U.S. Government ideas and thoughts on standardization. The SoS also envisions that the policy recommendations may be followed by a formal Administration memorandum providing further guidance relating to federal government engagement in standardization.

RECOMMENDATION:

- *The VCAT recommends that NIST continue its role in coordinating and facilitating the development, adoption and application of standards used by the Federal Government. The Committee notes that many of the standards adopted by NIST also have proven to be of significant utility to the private sector.*

4b Measurement Services

As a result of last year's in-depth exploration by the VCAT of NIST's programs and resources targeted at providing measurement services, the Committee made a number of key recommendations on how NIST could improve its ability to deliver timely and high quality measurement services through improved planning and resource distribution, a review of current business models and practices, and a more robust assessment of its measurement services programs. While NIST still has a number of issues to address, significant progress against these recommendations has been made.

2010 VCAT RECOMMENDATIONS:

- *"NIST management should analyze current and anticipated measurement requirements against currently available technology to determine new technology development needs as part of a strategic planning effort. This will allow NIST to concentrate its resources on developing new tools and providing unique measurement services.*
- *NIST management should ensure that staffing levels are sufficient to create bench depth in critical measurement programs.*
- *NIST management should assess its measurement services and ensure that they optimize the integrity and traceability of the measurement system while promoting maximum third-party participation.*
- *Pricing for NIST measurement services should be rationalized; does the cost of billing and collection exceed cost recovery?*
- *NIST management should expand assessment programs to include customers of NIST measurement services."*

RESPONSE: There was a clear need to improve the planning at NIST in order to ensure that the NIST research efforts were feeding the development of new measurement services and that these service development and dissemination efforts were adequately staffed. The recent NIST reorganization is major step forward towards strengthening the planning and integration of the NIST measurement service efforts. For the calibration services, one objective of the recent reorganization and, consequently, its impact is illustrated by creation of the new Physical Measurement Laboratory which has integrated the research, development, and dissemination phases necessary to support a robust system of weights and measures that is essential for a modern economy. For example, in mass metrology, the old organizational structure required coordination of groups from three different operational units, each with a different mission. Consequently, it was difficult for improvements in mass metrology made by the electronic kilogram project to lead to improvements in mass calibrations, and in new

training/measurement protocols for dissemination by the Office of Weights and Measures and the National Voluntary Laboratory Accreditation Program (NVLAP). By contrast in the new structure, the relevant groups are now in the same division. We believe that this consolidation will lead to more effective integration of research and facilitate the transfer of knowledge and technology into more efficiently managed measurement service delivery efforts.

NIST has recently launched a review of its laboratory activities to identify its core capabilities and prioritize its efforts in measurement services. This is an opportunity to prune areas that are no longer needed and bolster existing and potentially new efforts that have insufficient staffing.

The cost effective delivery of measurement services is essential for the health of these programs. NIST is taking steps to evaluate the pricing models for the delivery of its measurement services, specifically the current practice of charging full cost recovery versus a market-based pricing approach for its services.

NIST is also exploring other strategies to more cost effectively deliver measurement services. For development and use of traceable reference materials, NIST is exploring the use of third-party collaborators to assist in the measurement of its reference materials for more efficient and cost-effective development and delivery. In the area of calibrations, NIST also continues to invest in the development of measurement technologies that could be transferred broadly to industry as a more effective means of promulgating a traceable measurement system that is not as reliant on costly and time-consuming calibrations against primary standards. An example of this work is 10V DC voltage metrology. In this case, NIST researched, developed, and transferred the knowledge of fabrication of a superconducting circuit to a small company that can generate 10VDC with high accuracy. This company now sells 10V DC systems to industrial and military calibration laboratories that can use these instruments to calibrate instruments with a voltage reference almost as accurately as the ones available at NIST. This could be considered a prototype of a concept called “NIST on a chip” that is being discussed within parts of the measurement science community at NIST. Current efforts to strengthen the NIST technology transfer policy will further encourage efforts to commercialize NIST measurement technologies like the 10V DC standard.

NIST is still in the process of exploring additional assessment programs, beyond evaluation by the National Research Council, including the possible evaluation of service programs by personnel at other National Measurement Institutes as well as key customers. NIST is taking steps to expand the customer feedback that is collected for all measurement services including the possible use of a web-based customer management system to ensure that customer requests receive effective response.

RECOMMENDATION:

- *The Committee believes that it is critical for NIST to implement a revised assessment program and expects an update on this process at its June 2012 meeting.*

4c Safety at NIST

In the 2010 VCAT report, we recommended that NIST fully implement the recommendations of the NIST Blue Ribbon Commission on Management and Safety II (BRCII) report. Since that time, NIST has made significant progress addressing each of the four recommendations. The following summarizes progress to date:

BRC Recommendation 1: Appoint crucial Associate Director for Laboratory Programs (and Principal Deputy).

RESPONSE: In July 2011, NIST Director Patrick Gallagher appointed Dr. Willie E. May to the position of Associate Director for Laboratory Programs (and Principal Deputy). Prior to this appointment, Dr. May was the Director of

NIST's Material Measurement Laboratory. Dr. May's extensive leadership and management experience, knowledge of NIST's programs, and understanding of NIST's unique mission make him exceptionally well qualified to lead all aspects of NIST's laboratory programs.

BRC Recommendation 2: Address the enthusiasm gap in some senior management.

RESPONSE: In May 2011, Dr. Gallagher convened a two-day safety summit to develop a shared sense of direction and priorities among NIST's senior leaders. The discussions at the summit resulted in the following joint statement:

Safety commitment: We seek to make safety an integral core value and a vital part of the NIST culture. This has several key attributes:

- *Safety is an integral core value backed up by more than words, and includes full use of our appropriate authorities.*
- *Safety is how NIST performs its mission work ("safety as an adverb").*
- *We seek to build our safety culture on the strengths of our existing culture. For example, high standards of excellence; personal and professional integrity; recognizing achievement; merit as determined by robust peer review; etc.*

BRC Recommendation 3: Establish an Audit mechanism.

RESPONSE: NIST has drafted an assessment program as part of its overall safety management system. The assessment program, which is currently under review, includes requirements for independent third-party assessments.

The Nuclear Regulatory Commission provides significant external oversight of NIST's programs involving ionizing radiation. In addition, NIST contracts for independent third-party assessments of its ionizing radiation safety programs in both Gaithersburg and Boulder annually and has contracted for a comprehensive assessment of its radioactive materials programs in 2012.

Federal, State, and local regulatory agencies provide significant oversight of NIST's environmental management programs.

In August 2011, the Department of Commerce's Office of Occupational Safety and Health conducted an independent third-party evaluation of the NIST safety program focused on 29 CFR 1960, Basic Program Elements for Federal Occupational Safety and Health Programs, and on implementation of the NIST program at NIST Boulder.

NIST has initiated an assessment of its hazard review program. The assessment will comprise an independent third-party assessment of the NIST written program and the Operational Unit (OU) implementations thereof and internal peer-based assessments of approximately 50 specific activities.

BRC Recommendation 4: Develop a suite of safety metrics to gauge progress and drive improvements.

RESPONSE: NIST is in the process of developing a set of safety metrics to drive improvements in incident reporting and investigation. These metrics will be based on injuries, illnesses, near misses, spills, and other incidents and on the data collected through the NIST Incident Reporting and Investigation System (IRIS) launched in September 2010.

During 2012, NIST will be launching a new program focused on the reporting and amelioration of unsafe working conditions. This will be another source of data to gauge progress and drive improvements.

OBSERVATIONS:

NIST is currently monitoring six categories of recordable incidents shown below. The recordable incident data is collapsed into two standard metric rates, known as DART and TRC[6].

Recordable incidents:

1. Lost work activity – Days Away from Work
2. Restricted work activity – Days Restricted
3. Transfer to another job due to injury – Days Transferred
4. Medical treatment beyond first aid (non-lost time)
5. Loss of consciousness
6. Fatality related to work

NIST management has concluded that these metrics do not permit direct and targeted responses to the aggregated measurements. Moreover, the accumulated data is "noisy" owing to the small numbers involved. This makes it difficult to measure progress except over long periods of time. Consequently, a new set of safety metrics has been proposed, driven by the motivating factors shown below:

1. They touch on key aspects of a strong culture of safety (improving safety engagement, safety processes, safety leadership, and safety learning across the organization).
2. They connect to an area of high safety significance (preventing incidents from recurring, identifying and addressing both local and organization-wide safety weaknesses).
3. They are relevant to management and staff at all levels and across the entire organization.
4. They permit the OUs to improve continually through data-based safety management.
5. They are amenable to the NIST Office of Safety, Health, and Environment (OSHE) measuring and reporting on them relatively easily.
6. They involve a safety area that has been a major focus at NIST and where NIST has recently done an evaluation and established a baseline.

These new metrics will be monitored from April 1, 2012:

1. Quality of incident investigation reports.
2. Quality of initial incident reports.
3. Percentage of OUs with procedures implementing the NIST IRIS program.
4. Percentage of staff trained on OU procedures for reporting incidents and on their associated rights.
5. Percentage of staff trained on the conduct of incident investigations who will be performing incident investigations.

In addition, OSHE will report on the amount of time taken to submit initial incident reports and incident investigation reports, and on the number of outstanding incident investigation reports beyond specified timeframes.

[6] DART Rate = Number of incidents in categories 1, 2, and 3 per 200,000 employee work hours (roughly 100 full-time employees).
TRC Rate = Number of incidents in categories 1 through 5 per 200,000 employee work hours (roughly 100 full-time employees).

Related metrics that NIST will track in the future:

1. Percentage of corrective actions taken on time.
2. Number of outstanding corrective actions beyond the scheduled time.

RECOMMENDATION:

- *The VCAT expects a report on metrics in use and in development during the calendar 2012 VCAT period. In addition, the VCAT is specifically interested in the measurements taken by NIST to illustrate its progress in improving safety. The importance of this effort cannot be overemphasized.*

4d Progress on the NIST Reorganization

The Committee recognizes the significant progress that NIST has made in its continued efforts to reorganize and realign the laboratory programs. Specifically, the appointment of Dr. Willie May to the position of Associate Director for Laboratory Programs fills a much needed leadership position that will enable the continued implementation of the NIST reorganization, provide leadership stability in times of transition, and provide continued focus and strategic prioritization of efforts to grow and strengthen the NIST laboratory programs.

The Committee realizes that there is still significant work to be done to ensure that the NIST reorganization is a success. Perhaps the biggest challenge lies in the ongoing restructuring of the Material Measurement Laboratory and the Physical Measurement Laboratory, which together are the two largest scientific OUs at NIST with combined responsibility for the core metrology mission. Given the ongoing efforts to strengthen measurement

services as discussed earlier, it is critical that these two units ensure that a core base of fundamental research is maintained and is vertically integrated with new service delivery capabilities that are closely tied to the need of NIST's stakeholders in government and industry.

The Committee applauds the creation of the Chief Manufacturing Officer position at NIST. With the newly announced leadership role of the Department of Commerce in the Administration's manufacturing policy and the critical role of NIST, it is important that NIST has a leadership post that can serve as a key point of coordination both within the government and with the private sector.

RECOMMENDATIONS:

- *The VCAT strongly recommends that NIST engage in capacity, skills and leadership planning and looks to NIST to report progress at the June 2012 VCAT meeting.*
- *The VCAT requests that NIST management articulate the inter-laboratory coordination mechanisms it uses to address new opportunities, build staff competency in new areas and adapt to new budget and tasking from the many sources that drive NIST's agenda.*

5. NIST Strategic Planning and Performance

NIST continues to improve its programmatic planning efforts. Building on progress it has made over the last three years it has identified a series of strategic priorities and investment priority areas (IPAs) against which future planning would be conducted.

As with last year, the programmatic planning efforts are directed toward a series of six IPAs: Physical Infrastructure, Energy, Environment & Consumer Safety, Healthcare, Information Technology & Cybersecurity, and Manufacturing. These IPAs were selected by senior NIST management and technical staff, along with inputs from other stakeholders, based on the following criteria:

- Clearly matches NIST's mission and goals;
- Addresses urgent national needs and priorities, including Administration and Congressional priorities;
- Addresses a compelling innovation or competitiveness issue in areas of strategic importance to the nation (e.g., manufacturing, alternate energy, safety and security); and
- Represents previously identified NIST priorities that remain important.

The programmatic planning process is moving the agency away from single year initiative-based planning, and toward the creation of culture and infrastructure that enable the development and maintenance of multi-year program plans with discrete goals, objectives, and performance measures.

RECOMMENDATION:

- *The VCAT endorses the strategic planning process and supports the six investment priority areas. The VCAT is looking for more clarity and depth in strategic planning, recognizing that NIST operates in a dynamic environment in which demands arise from a variety of sources that can and do influence its ability to adapt.*

5a NIST Three-Year Programmatic Plan

The Committee has read and reviewed the draft NIST three-year programmatic plan as of January, 2012 and believes that it accurately portrays the near-term path of activity and development at NIST.

RECOMMENDATION:

- *While the Committee does not have specific recommendations stemming from the three-year programmatic plan, it does urge NIST management to develop a longer-term strategic perspective of evolving agency needs and challenges from which the programmatic plan may be derived.*

6. NIST Budget

NIST Budget (Dollars in Millions)

	FY 2010 Enacted	FY 2011 Enacted	FY2012 Enacted	FY2013 Request
Scientific and Technical Research and Services (STRS)	**$515.0**	**$497.4**	**$567.0**	**$648.0**
Industrial Technology Services (ITS)	**$194.6**	**$182.8**	**$128.4**	**$149.0**
Advanced Manu Tech. Consortia	0	0	0	21.0
Technology Innovation Program	69.9	44.8	0	0
Baldrige Perf. Excellence Program	9.6	9.6	0	0
Hollings Manufacturing Extension Partnership	124.7	128.4	128.4	128.0
Construction of Research Facilities (CRF)	**$147.0**	**$69.9**	**$55.4**	**$60.0**
Total NIST Discretionary	**$856.6**	**$750.1**	**$750.8**	**$857.0**
Mandatory Appropriations	**0**	**0**	**0**	**$1,300.0**
Wireless Innovation Fund	0	0	0	300.0
National Network for Manufacturing Innovation	0	0	0	1,000.0
Total NIST	**$856.1**	**$750.1**	**$750.8**	**$2,157.0**

6a FY 2012 Appropriations

OBSERVATIONS:

A highlight of the FY 2012 funding was the $69.6 million dollar increase in funding provided to the NIST laboratory programs. The Committee applauds this increased support that will strengthen NIST capabilities in manufacturing and a number of other areas, and is illustrative of the critical role that NIST plays in supporting technological innovation.

NIST's Industrial Technology Services account is significantly cut in the FY 2012 appropriations, with the Technology Innovation Program (TIP) and the Baldrige Performance Excellence Program (BPEP) being eliminated from Federal funding, and no funding provided for the proposed AMTech program. With respect to TIP, the Committee applauds the professional manner in which NIST is handling the shutdown of the program and the efforts being undertaken to minimize the impact to the program's staff.

The VCAT notes that there is no continuing funding in FY 2012 for the BPEP. The Committee is grateful to the Baldrige Foundation for the gift that will enable the program to operate through FY 2012. The Committee looks forward to working with NIST management and the BPEP leadership to ensure a successful transition of the program over the coming year.

Although incremental funding for the AMTech program was not provided in FY 2012, the VCAT strongly believes that this model of public-private partnership is a powerful tool for addressing key challenges in technological innovation. The VCAT endorses NIST's effort to establish manufacturing consortia and other initiatives, where possible, to leverage the capabilities of the NIST labs with those of industry and academia to overcome precompetitive challenges and to reduce barriers to innovation.

The Committee agrees with NIST leadership that the laboratory mission is its top priority, and that these programs should continue to be prioritized and optimized. The Committee believes that NIST, because of its non-regulatory role, has a uniquely valuable convening capability linking government and industry.

The VCAT believes that the NIST coordination role must be supported in such a way as to preserve the laboratory programs that are at the core of the NIST mission.

RECOMMENDATIONS:

- *The VCAT recommends that NIST continue to work proactively to fulfill both its coordinating responsibilities and its measurement sciences programs.*
- *The VCAT reiterates its earlier recommendation that NIST take steps to assure that there is sufficient funding to maintain an optimal level of technology in support of NIST's mission.*

6b FY 2013 Request

The President's FY 2013 budget for NIST proposes an appropriations funding level of $857 million, an increase of $106.2 million from FY 2012.

More than half of the proposed increased funding would be focused on advanced manufacturing research both at NIST laboratories and through the AMTech program, which the VCAT strongly supports. Increases to the laboratory research programs include:

- Measurement Science for Advanced Manufacturing (+$45 million)
- NIST Centers of Excellence (+$20 million)
- Measurement Science and Standards in Support of Forensic Science (+$5 million)
- Measurement and Standards for Disaster Resilience and Natural Hazards Risk Reduction (+$5 million)
- Measurement Science to Support Advanced Communications Networks (+$10 million)
- National Strategy for Trusted Identities in Cyberspace (+$8 million)

The VCAT is supportive of the requested increases to the NIST laboratory programs, and believe that they will both increase capabilities at NIST, and create improved partnership opportunities with industry and academia, enabling NIST to interact more effectively across the innovation ecosystem.

The VCAT is supportive of the proposed $128 million for the Manufacturing Extension Partnership (MEP) and the requested $21 million for AMTech. While $21 million will be sufficient to launch the program, as previously stated, the VCAT strongly recommends that the AMTech program be funded at a level that would enable it to have maximal impact.

With respect to the $60 million for Construction of Research Facilities, the VCAT is pleased to see that the much needed renovations to the Boulder Campus will be able to continue, albeit at a much reduced rate. The VCAT is concerned that the $48.2 million proposed for NIST's routine maintenance and repair budget is not sufficient to effectively maintain NIST's laboratory facilities, especially given the aging nature of the General Purpose Laboratories and the significant increases in new facilities through the American Recovery and Reinvestment Act (ARRA) construction. The inability for NIST to effectively address major repair needs could negatively impact the safe and efficient operations of NIST.

The VCAT is eager to learn more about the President's request for an additional $1 billion in mandatory funding to establish a National Network for Manufacturing Innovation (NNMI), a collaborative effort between the Department of Defense, the Department of Energy, the National Science Foundation and NIST to promote the development of manufacturing technologies with broad applications. The VCAT looks forward to working with NIST over the coming year to help define and scope this potentially transformational new program.

Having focused this past year on Public Safety Communications, and with publication of the report, "*Desirable Properties of a National Public Safety Communication System,"* the VCAT is highly supportive of the requested $300 million for a next generation Public Safety Communications program as part of the Wireless Innovation Fund.