NISTIR 7398

Selected Impacts of Documentary Standards Supported by NIST

Erik Puskar
Standards Coordination and Conformity Group
Standards Services Division
Technology Services

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

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U.S. DEPARTMENT OF COMMERCE
Carlos M. Gutierrez, Secretary
TECHNOLOGY ADMINISTRATION
Robert Cresanti, Under Secretary of Commerce for Technology
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
William Jeffrey, Director

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List of Acronyms

ACI	American Concrete Institute
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	American Society for Mechanical Engineers
ASTM	ASTM International, formerly American Society for Testing & Materials
CIE	International Commission on Illumination
CIPM	International Committee for Weights and Measures
CISPR	The International Special Committee on Radio Interference
CLSI	The Clinical and Laboratory Standards Institute
DHS	Department of Homeland Security
DOE	Department of Energy
FIPS	Federal Information Processing Standard
HITSP	Health Information Technology Standards Panel
HL7	Health Level 7
ICAO	International Civil Aviation Organization
IEC	International Electrotechnical Commission
IEEE	Institute of Electronic and Electrical and Electronics Engineers
IESNA	Illuminating Engineering Society of North America
IETF	Internet Engineering Task Force
IFSTA	International Fire Service Training Association
ILO	International Labour Organization
INCITS	International Committee for Information Technology Standards
iNEMI	The International Electronics Manufacturing Initiative
IPC	formerly Institute of Interconnecting and Packaging Electronic Circuits
IT	Information Technology
ISO	International Organization for Standardization
ITU	International Telecommunication Union
JTC1	ISO Joint Technical Committee 1 (Information Technology Standards)

NEMA	National Electronics Manufacturers Association
NFPA	National Fire Protection Association
NIJ	National Institute of Justice
NIST	National Institute of Standards and Technology
OAG	Open Applications Group
OASIS	Organization for the Advancement of Structured Information Standards.
OIML	International Organization for Legal Metrology
SAE	SAE International, formerly Society of Automotive Engineers
SCP	Standards Committee Participation Database
SI	International System of Units
SSL	Solid State Lighting
STEP	Standard for the Exchange of Product Model Data
TIA	Telecommunications Industry Association
UL	Underwriters Laboratories Inc.
VESA	Video Electronics Standards Association
W3C	World Wide Web Consortium

I. Background

During 2006 the Operating Units (OUs) of the National Institute of Standards and Technology (NIST) were canvassed for instances where NIST has played an active role in the development or implementation of documentary standards that: (1) have been broadly adopted, or (2) have produced or are expected to produce significant economic or societal benefits. This study reports on the results of this survey. This is part of a broader Technology Services (TS) effort to assess the impact of standards on global competitiveness and innovation. It also supports one of the Director's strategic priorities for NIST. That priority involves fostering more efficient transactions in the domestic and global marketplace through the development and use of effective standards by both the manufacturing and service sectors.

The American Competitiveness Initiative highlights NIST's role in supporting the development of standards used by the public and private sectors. NIST participation includes: carrying out research that provides the technical underpinning for standards; participating in standards development activities in a broad range of technical areas; providing technical information related to standards; participating extensively in international industrial consortia; and, in some cases, providing calibrations and standard reference materials (SRMs) called for in the standards. Congress has recently given NIST additional standards-related responsibilities in several specific areas of current national interest, including: IT security, biometrics and voting. In particular, under the National Technology Transfer and Advancement Act (NTTAA), Congress has charged NIST to coordinate standards activities among Federal agencies and with State and local governments for the purpose of promoting participation in private sector voluntary standards activities and making greater use of available voluntary standards rather than relying or depending on developing in-house standards.

In understanding NIST's commitment to the development of high quality standards, it is useful to know where and how many NIST staff members participate in the activities of key standards development organizations (SDOs). Staff participate on committees where they have technical competence and concern for ensuring representation of national interests. The Standards Committee Participation (SCP) database attempts to capture all NIST participation in the committees of SDOs and consortia. According to the database, almost 400 NIST staff members currently participate in the development of private sector documentary standards. Table 1 displays the number of NIST staff members currently participating in the standards activities of the listed SDOs. The data are organized by NIST OU. As of December 2006, there were a total of 384 NIST participants holding a total of 1342 committee memberships. As the data indicate, NIST's commitment of resources to the development of documentary standards is substantial.

Table 1. NIST Participation in Standards Committees by OU

OU	No. of Staff Members	Committee Memberships	No. SDOs	Top SDO's (# membership)
Office of the Director (OD)	5	8	3	ANSI (1)[1]
Technology Services (TS)	32	179	19	ASTM (51) OIML (48) ANSI (20)
Advanced Technology Program (ATP)	2	2	2	ASTM(1)
Electronics and Electrical Engineering Laboratory (EEEL)	45	159	17	ASTM (33) IEC (27) IEEE (21)
Manufacturing Engineering Laboratory (MEL)	51	180	29	ASME (48) ISO (28) ASTM (15)
Chemical Science and Technology Laboratory (CSTL)	69	194	29	ASTM (89) ISO (14) ASME (11)
Physics Laboratory (PL)	49	208	24	ASTM (53) CIE (27) IEEE (15)
Materials Science and Engineering Laboratory (MSEL)	31	129	11	ASTM (76) ISO (20) ADA (18)
Building and Fire Research Laboratory (BFRL)	40	159	17	ASTM (76) ACI (19) NFPA (16)
Information Technology Laboratory (ITL)	60	124	25	INCITS (26) IETF (15) W3C (13) ISO (6)
Totals	**384**	**1342**		

[1] ANSI is not an SDO, but coordinates the development and use of voluntary consensus standards in the United States and represents the needs and views of U.S. stakeholders in standardization forums around the globe. NIST staff chair or participate in a broad range of ANSI policy committee activities. In addition, some of the activities counted as "ANSI" activities reflect NIST staff participation in ANSI-accredited standards committees, which are administered by other SDOs.

II. Methodology

The data in the above table were used to direct the search for specific standards development activities where NIST's participation might have produced significant, positive impacts. Emphasis was placed on identifying standards efforts that were fairly recent and that resulted in (or were expected to result in) either broad adoption of the standard or significant economic or social impact. The intent was to limit the collection of information to a handful of successful documentary standards efforts and to use this information as a basis for choosing those activities that would be the subject of future retrospective case studies. A template was designed to capture specific data elements, including: the name of the OU; title of standards effort; description of the standard and NIST's involvement; the actual or expected economic or social impact of the standard (or level of adoption); the SDO or consortium involved; the primary NIST contact(s); and the status of NIST's work.

A number of individuals from different NIST OUs were interviewed and an initial table of findings was prepared. Selection of interviewees was partially based on the recommendations of TS management. Based on leads that resulted from this initial set of interviews and other information, a matrix of high impact standards efforts was prepared. While the impacts described were not supported by quantitative data, the qualitative (though subjective) reports and data provided by the participants still provided some support for believing that these impacts were real and significant. While not all standards committee participation activities identified within the SCP were surveyed, this table does represent a fairly comprehensive list of recent, key NIST documentary standards initiatives.

III. Results

The results of the canvassing effort are provided in Table 4, which due to its length can be found at the end of the paper. It contains 55 entries, listed by OU in alphabetical order. The impacts identified are very broad and significant and cut across all laboratories and diverse technical areas and applications. Table 2 contains a sample of these to illustrate the wide variety and the broad scope of the impacts and the resulting public benefits.

Table 2. Overview of Impacts Derived from NIST Supported Standards Efforts

OU	Project/SDO	Impact
BFRL	Fire Test Methods and Standards **ASTM/NFPA/ISO**	The number of life loss fires has been significantly reduced over the last several decades. Fire test methods initially developed by NIST are now used nationally and internationally. *(Public safety)*
CSTL	In Vitro Diagnostics **CLSI, ISO**	NIST developed many of the approved methods and materials used by industry. U.S. industry is the world leader in IVD market. These standards allowed U.S. industry a level playing field in Europe where U.S. firms have over half of the $6 billion IVD medical device market. *(Market Access)*
EEEL TS	Performance Standards for Body Armor **NIJ, ASTM**	Body armor made to NIST developed performance standard is credited with saving over 2500 lives. Since 1999, over 11 900 jurisdictions have participated in the Bulletproof Vest Program to support purchase of approximately 450 000 vests. *(Public safety)*
ITL	Personal Identify Verification (PIV) **FIPS**	FIPS 201 developed in response to Homeland Security Presidential Directive-12. Agencies were required to begin implementation in Oct 2006. This standard will improve security of physical and logical assets and reliability of federal identification credentials. Smart card industry is lining up to develop products. *(Public safety)*
MEL	Standard for the Exchange of Product Model Data (STEP) **ISO**	STEP is used in most key complex manufacturing industries such as automotive, aerospace and ship building. NPV over $1 billion calculated in previous NIST study. *(Interoperability)*
MSEL	Rockwell Hardness Test **CIPM, ASTM, ISO**	Has broad applicability for worldwide metallurgical use. Huge impact on the trade of metals. Establishes national chain of traceability to fundamental SI units. Disputes between producers and users are curtailed. *(Quality)*
PL	Standards on Solid State Lighting (SSL) Products **IESNA, ANSI**	These standards will facilitate development and commercialization of energy saving SSL products and contribute to the new Department of Energy *ENERGY STAR* specification for solid state lighting products. *(Market creation)*

IV. Findings

The results of the canvassing identified 55 documentary standards efforts that are considered to have significant impact, or that are widely used and adopted. It is important to note that the impact/benefits noted in the table were obtained primarily from interviews or written input provided by the participants. In only a few cases were the impacts/benefits based on quantitative data or previous study results.

NIST Participation

NIST provides technical leadership in standards development in a number of technology areas. NIST also works closely with industry to translate NIST research results into appropriate standards. A common theme of the standards efforts documented in Table 3 was NIST support for testing and other conformity assessment activities associated with the standards. Other NIST contributions included: conducting research that formed the basis of the standard; working cooperatively with industry to establish appropriate requirements; and developing applicable software. The value of NIST's participation in documentary standards efforts is well appreciated by users of the standards. For example, the Home Safety Council states that "… NIST contributions to fire research and standards development have been a cornerstone for fire safety education efforts nationally."[2] Also, according to the Wireless Communications Association "tireless efforts by the 802.16 chair and the dedicated core group of executives whom he has recruited have made enormous advances in voluntary standards for broadband wireless."[3] A NIST researcher led the 802.16 working group. There are many other similar testimonials in support of NIST's leadership and involvement in documentary standards efforts.

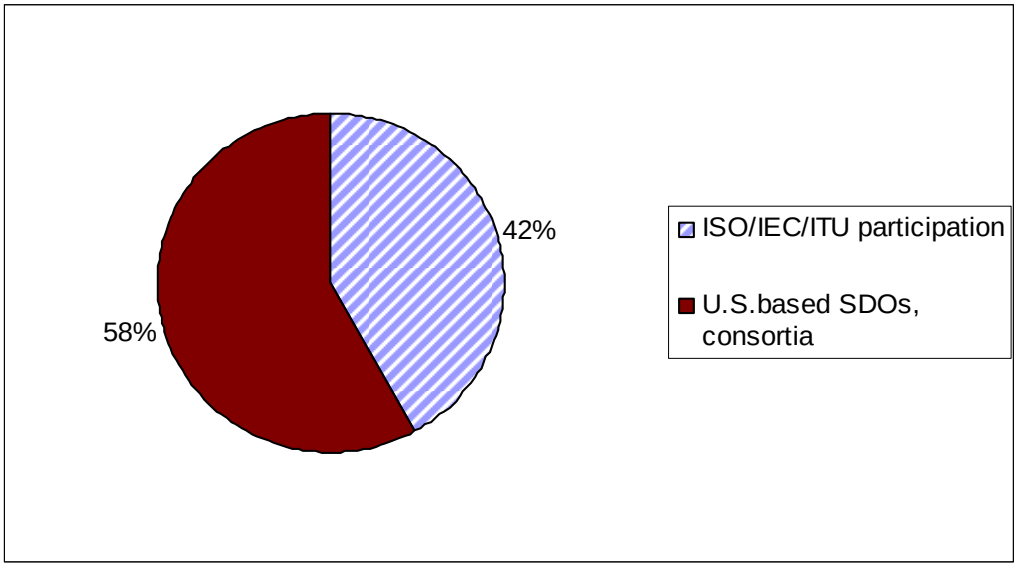
It is interesting that 23 of the 55 standards efforts identified (42 %) can be categorized as falling under one of the Office of Science & Technology Policy's priority areas (energy efficiency, clean technologies, health informatics, data privacy/ID theft, IT security, robotics, accessibility and assistive technologies, and nanotechnology) or under one of NIST's previous programmatic Strategic Focus Areas. Of these 23 standards, eight involved homeland security; four energy efficiency; four knowledge management; three health or health informatics; three IT security; and one accessibility. It should be noted that this type of information could be useful in better focusing NIST standards development work in the future. This information could be used as a factor in the development of the strategic framework for standards development and implementation that is being considered by NIST management.

An additional observation regarding the 55 identified high impact standards is that 23 of them were adopted or developed by the three major international standards organizations (ISO/IEC/ITU). Based on SDO membership reported by NIST staff listed in Table 1, this

[2] Statement by the President of the Home Safety Council, 2007
[3] Statement by the President of Wireless Communications Association International, 2002

figure is somewhat higher than would be expected. It may indicate that many of the standards efforts considered to have had a significant impact by the NIST OUs required broad, international cooperation where national participation is a priority. This is valued by industry specific sectors and helps assure that U.S. companies maintain their competitive advantage in the national and international market place. In the remaining 32 cases, NIST involvement focused on supporting U.S.-based standards developing organizations or consortia, many of whose standards and specifications are used globally. (see Figure 1).

Figure 1: Breakdown of Standards Participation by Organization Type



Reported Impacts

Based on the reported information, the impacts were divided into two primary categories -- economic impacts and social impacts. These two categories were then subdivided into eight sub-categories (see Table3). It should be noted that this categorization was primarily based on impacts reported by the respondents, hence the results are somewhat subjective.

An **economic impact** results when a standard leads to direct economic gains when the standard is used. Economic impacts include: (1) market creation or increased market access leading to increased revenues; (2) providing for interoperability or compatibility between products as part of a system or network or between different parts of a product which lowers the cost of designing and producing the products; (3) improved quality or reliability which improves functionality and increases consumer satisfaction and perception of the product and results in fewer recalls; and (4) providing information (producer/user/public) to overcome market failures. Most cases of reported efficiency and productivity improvements from a standard fell under the categories of interoperability or improved quality. Several previous economic studies have

demonstrated that standards are associated with a measurable proportion of the growth of productivity in the long run.[4]

Economic benefits were deemed to be the primary impact for 37 (67 percent) of the standards. Of the economic impact sub-categories, increased market share was a key impact for 15 of the 55 standards. This impact resulted either from *market creation,* where the standard helped facilitate the adoption of a new technology and its commercialization, or from increased *market access,* where the standard helped U.S. industry gain or preserve market access in an existing or mature market. These economic benefits translate into tangible benefits for individual firms. One company which uses ASTM standards for advanced ceramics states adoption of the standard "added credibility our existing customers were looking for and convinced potential customers about the accuracy and reliability of the measurement technique and the results that are obtained."[5]

A **social impact** results when the use of a standard leads to some social or public gain beyond the private return received by companies involved in the standards setting process. Social impacts identified include: (1) improved public and individual safety; (2) health benefits; (3) environmental benefits; and (4) improved voter confidence through voting systems standards.

For 18 of the 55 standards (33 percent), the primary impact was judged to be social; and the majority of these involved public and private safety. This is partly attributable to the fact that eight standards directly involved homeland security issues.

Table 3. Reported Primary Impacts

Category	Number
Economic Impacts	33
Market creation/access	15
Interoperability	8
Quality/reliability	11
Provide information	3
Social impacts	18
Safety (public and individual)	13
Health	3
Environment	1
Voting	1

The identified benefits do not imply that the change resulting from a standard has resulted in a net economic benefit. Further detailed study would be needed to analyze the net benefits of such change and both economic and social benefits may be quantified in

[4] "The Empirical Economics of Standards", DTI Economics Paper No. 12, London. June 2005.
[5] Letter from the General Manager of J.W. Lemmens, Inc., October 1998.

monetary terms if adequate and appropriate data are available. While most of the standards resulted in multiple impacts, each standard was classified only once based on its perceived primary impact. The category selected either reflected the ultimate goal of the standard or the impact that was considered to be most significant. For example, the adoption of the first generation of national and international biometric standards by large national (e.g., Department of Homeland Security, Department of Defense) and international (e.g., International Civil Aviation Organization, International Labour Organization) user organizations will lead to many positive economic and social benefits. It can be argued that the ultimate goal for biometrics standards is increased public safety, and thus biometric standards were placed in this category. Similarly, the standard for solid state lighting (SSL) was classified under energy savings since the ultimate goal is seen as promoting energy savings for the nation. However, another important objective of both of these groups of standards is to facilitate the development and commercialization of products incorporating these technologies.

V. Future Steps and Conclusion

This study is the first in a series of planned studies by Technology Services aimed at assessing the impacts of specific standards on U.S. industries' competitiveness and level of innovation. From the 55 projects identified in this canvassing effort, a few will be chosen as potential case study candidates. NIST guidance for assessing economic impacts states that taking a 'target of opportunity' approach for selecting projects to study is a practical way to proceed when not part of a broader program evaluation effort. A project should be selected based on indications that substantial market impact has occurred or is likely in the near future.[6] The perceived importance of NIST's contribution to the standardization effort will also be considered.

It should be noted that there are many hurdles in the development of economic studies that attempt to measure and describe the quantitative impact of documentary standards. The primary one is that there is currently no adequate methodology for determining the quantitative impact of standards across all markets. An additional problem involves the lack of publicly available quantitative data on the cost and impact of specific standards. NIST staff supporting standards development should also be cognizant about gathering data that can be used to estimate benefits. This topic is beginning to be addressed by other government organizations and SDOs, which have recently released or are about to release studies on the impact of standards. These results will be reviewed and taken into account when designing future studies.

In the future, prospective studies of key technologies or sectors are also planned to identify, measure and assess key aspects of technology and market forces with the associated standard(s). These studies should yield analytical methodologies that will support NIST efforts to implement a more strategic approach to its standards efforts. The studies will also enhance NIST's ability to better support industry, government and other

[6] Methods for Assessing the Economic Impacts of Government R&D (Planning Report 03-1), NIST, September 2003

stakeholders by participating in standards areas that are most likely to result in safer, more reliable, interoperable products and enhanced U.S. global competitiveness and innovation. For example, ISO is engaged in or considering strategic initiatives relating to security, nanotechnology, energy and biotechnology.[7] These areas are priorities for NIST and leadership of relevant ISO activities should be considered.

The contents of Table 3 should be updated on an annual basis to keep this listing current. Such updating would serve to emphasize that participation in documentary standards activities is an important component of NIST's mission. If necessary, more detail could be captured on any of the 55 identified documentary standards by using data provided by the cognizant contact points and OU's. The collected information could also be displayed in presentation format using a "Standard On a Page" viewgraph to summarize NIST's involvement in developing a standard, along with the resulting impact. These one page slides could be used to provide information, conduct outreach and other related purposes. Figure 2 contains a suggested template and a completed example is provided in Figure 3. A separate document containing a collection of such slides could be published to highlight NIST's work on documentary standards and shared with our stakeholders.

In conclusion, the information compiled from the OUs in Table 3 reflects NIST's important work in supporting standards development activities – especially significant international participation -- and how these efforts result in broad-based economic and social benefits. Continuing to focus on standards development efforts in key technologies and sectors will support U.S. innovation and competitiveness and help U.S. technology and standards gain global acceptance. NIST staff can help ensure that the best technical input is provided to support the development of key documentary standards. Better reporting and promotion of standards activities will also serve NIST well.

[7] Presentation by George Arnold, Deputy Director, Technology Services on December 12, 2006

Figure 2. Proposed Standard on a Page Template

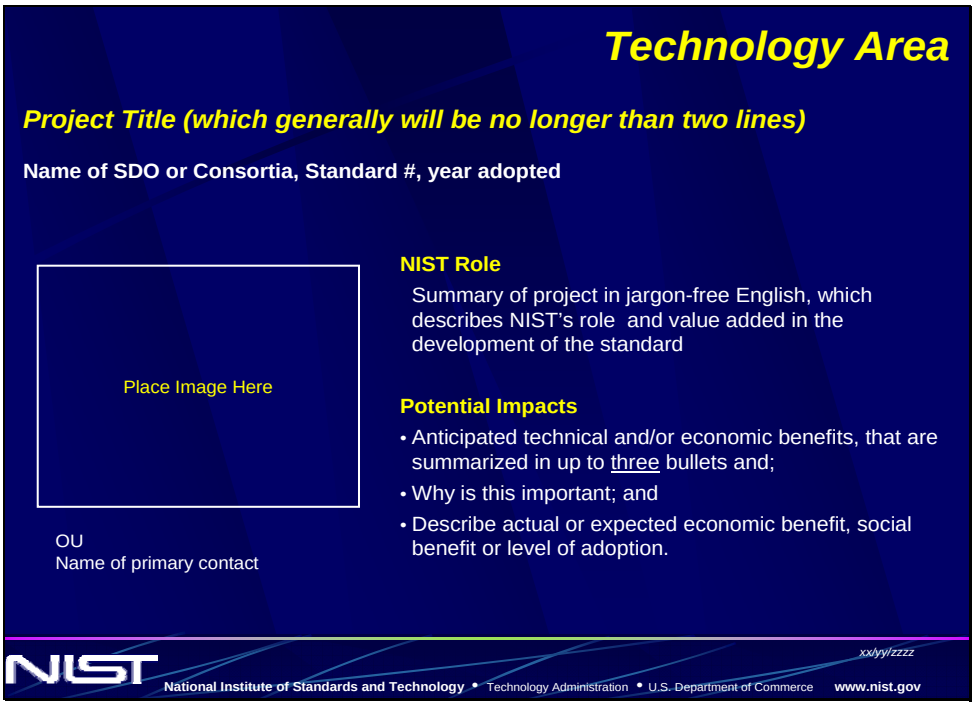


Figure 3. Public Safety Standards

Table 4. Canvassing Results: NIST Supported Documentary Standards Efforts Having High Impact

Lab	Title	Description	Impact	SDO	Contact	Completed?
BFRL	Fire/Smoke Detectors	NIST has been key player in research and standards work for smoke detector tests. Levels of protection standard and Indiana Dunes Tests are key achievements.	Cut loss of life by 50 % between 1975 and 1998. Adoption of standards and codes internationally.	NFPA UL (1974)	Dick Bukowski	Yes
BFRL	Standard Fire Service Interface	Cooperative program with fire alarm industry for interface to fire departments. NIST is leading the collaboration as well as the effort to write standard	Potential for improved public safety in large commercial buildings. Being implemented by large integrators but standards has not been sold in large numbers yet. City of Boston to mandate its use. Enabling technology for related applications.	NFPA (2002) NEMA (2005)	Dick Bukowski	Yes
BFRL	WTC investigation impacts	As a result of the extensive WTC investigation, 30 specific code change recommendations have been made. 19 proposed changes to model building codes have been submitted to the ICC. Standards will also be revised	Improved building and occupant safety through stronger building codes and standards will result in improved public safety.	ASTM (2006)	Dick Bukowski	No (standards efforts ongoing)

Lab	Title	Description	Impact	SDO	Contact	Completed ?
BFRL	Standard Guide for Development of Standard Data Records for Computerization of Thermal Transmission Test Data for Thermal Insulation	In the 1990s, NIST developed Standard Reference Database 81, "*NIST Heat Transmission Properties of Insulating and Building Materials*." Recognizing that continued development in this area required a standard recording format, NIST was a driving force behind the development of a standardized recording format within ASTM Sub-committee C16.30. This standard, C 1558, is the latest contribution made by NIST to C16. NIST's involvement in C16 has spanned over 60 years. C1558 includes the following standards on the guarded-hot-plate apparatus: Test Method C 177, Practice C 1043; and Practice C1044.	Guide 1558 is the first step in establishing interoperability among the thermal insulation user community in exchanging thermal transmission test data from standard test methods. This standard can be utilized by manufacturers internally to compare process specifications and externally to exchange data with clients or other interested parties.	ASTM	Robert Zarr	Yes
BFRL	Ventilation for Acceptable Indoor Air Quality	NIST was involved in a major revision of the 1989 version of the ASHRAE standard 62.1, which took 12 years to complete. The goal of the revision was to update the technical content of the standard as well as to convert the standard into mandatory and enforceable language suitable for adoption into building codes and other appropriate regulations. NIST contributed its ventilation and indoor air quality expertise to the process and provided leadership to the committee.	This standard is leading to improved indoor air quality buildings, which in turn has been shown to reduce health care costs and improve occupant productivity. The new format of the standard (i.e., the use of normative language) is also helpful to designers and manufacturers because it makes compliance and enforcement much more predictable.	ASHRAE	Andy Persily	Yes

Lab	Title	Description	Impact	SDO	Contact	Completed ?
BFRL	Methods of Testing for Rating Electrically Driven Unitary Air-Conditioning and Heat Pump Equipment	ASHRAE Standard 37 describes the test methods – both primary and confirming – used to measure the steady-state cooling and heating capacities of conventional air conditioners and heat pumps. The 2005 revision incrementally improves the accuracy, consistency, and applicability of these methods. NIST took a lead role in the 2005 revision because of its unique and long-standing role of developing and maintaining the technical content of federally mandated air conditioner and heat pump testing and rating requirements, which reference consensus standards like ASHRAE 37 to the extent feasible.	The standard – that provides both primary and confirming test methods – acts as the basis for the different performance ratings used to compare and market the millions of air conditioners and heat pumps sold in the United States and Canada each year.	ASHRAE (2005)	Brian Dougherty	Yes
BFRL	Air Conditioning and Heat Pump Testing and Rating Standards	ISO 5151 Non-ducted Air Conditioner and Heat Pumps; ISO Standard 13253, Ducted Air Conditioners and Heat Pumps; ISO Standard 15042, Multi-Split System Air-Cooled Air Conditioners and Air-to-Air Heat Pumps. Each standard covers test methods and rating conditions for both capacity/efficiency tests and pass/fail extreme operations tests. The current drafts of ISO 5151R and 13253R are first revisions of existing standards developed in 1994. NIST took a lead role on the cognizant ISO working group because of interest by both the U.S. Dept. of Energy and U.S. air conditioner and heat pump manufacturers in working towards the adoption of international standards.	These ISO standards are too different from the current U.S. standards to gain immediate adoption. The same condition applies to the European Union that relies on CEN standards. However, the forthcoming ISO standards do provide a target for U.S. standards bodies and CEN to work towards as they periodically revise their own standards. Hopefully, in the future, both the U.S. and the EU will be able to coordinate their respective standards and regulatory bodies to allow adoption of the ISO standards.	ISO	Brian Dougherty	No – All 3 standards await balloting at the Final Draft International Standard (FDIS) stage

Lab	Title	Description	Impact	SDO	Contact	Completed ?
BFRL	Fire Test Methods and Standards	Fire research activities have led to the development of ignitibility test methods, surface flammability test methods, furniture flammability test methods, heat release rate test methods, and procedures for measuring the toxicity of combustion products. NIST has lead efforts within the U.S. on fire test standards development.	The number of life loss fires has been significantly reduced over the last several decades. Building materials have better fire resistant properties. Construction practices have changed to reflect a better understanding of unwanted fires, and the ease of ignition. Flammability of furnishings used in offices and homes has been reduced and less toxic building materials and furnishings have been developed. Fire test methods initially developed by NIST are now used nationally and internationally.	ASTM, NFPA, ISO	Randy Lawson	Ongoing
BFRL	Fire Service Standards	NIST has advanced firefighter safety through research on a range of safety issues: personal protective clothing and equipment (PPE); electronic equipment (PASS devices, radios, and thermal imaging systems); automatic water sprinklers; and fire fighter training and suppression tactics. In addition, NIST has produced computer fire simulation capabilities and has used them for the investigation of serious fire incidents. Findings from this research have been coupled with standards for protecting and training fire service personnel.	NIST research on low heat flux burn injuries brought about improvements in NFPA protective clothing standards that affect firefighter safety. This directly influences burn injury rates, monetary losses, and social loss costs to the nation. Work on electronic equipment has brought about changes in standards for PASS devices and radio systems improving their reliability. Research on thermal imaging systems has resulted in a new standard that is also helping to protect firefighters. Computer simulations of firefighter life loss fires have brought about changes in standards for training .	NFPA, ASTM, IFSTA	Randy Lawson Nelson Bryner	Ongoing

Lab	Title	Description	Impact	SDO	Contact	Completed ?
CSTL	In Vitro Diagnostics (IVD)	U.S. industry came to NIST for help in developing reference measurement procedures and materials for meeting 1998 EU IVD directive. NIST has key leadership roles in CLSI, JCTLM, and U.S. TAG for ISO TC 212. Resulted in several ISO standards. NIST developed many of the approved methods and materials used by industry. NIST is still working with industry in developing documents for traceability and uncertainty within the CLSI and ISO framework.	U.S. industry is world leader in IVD market. These standards gave U.S. industry a level playing field in Europe. U.S firms currently have 60% of the ~$6 billion/year IVD medical device market in Europe.	CLSI ISO (2002)	Bill Koch	Yes - but other key related standards still under development
CSTL	Alternative Refrigerants	NIST engaged in research that would allow industry to make the switch to alternative refrigerants in a timely and economic fashion to meet the timetable imposed by the Montreal Protocol of 1987 to develop alternatives to CFCs. NIST researchers developed the REFPROP database which contains precompetitive properties data so that industry could design their own proprietary CFC alternatives. ISO has incorporated this into their standard.	A comparison of industry benefits with the funding stream of NIST's research program estimated a social rate of return of at least 433 % and a BC ratio of 4 to 1 (1998 study).	ISO (2004)	Mark Mclinden	Yes
CSTL	Restriction of certain Hazardous Substances in Electronic Products (RoHS)	NIST is Working with IEC TC111 Working Group 3 drafting and validating IEC CDV 62321, a set of standard test methods for testing products for hazardous substances. NIST also holds membership in ASTM International Committee F40, which is developing standard test methods for hazardous substances in raw materials used in the electronics industry.	Standard test methods are needed for companies in the electronic and electrical products manufacturing supply chain to enable them to make accurate declarations of hazardous substances content and shield themselves from the risk of being banned from markets and fined. Supports U.S. competitiveness in the EU, China and other markets.	IEC and ASTM International	John Sieber	Ongoing. More validation studies required. Expected to be converted to final draft international standard in Dec. 2007

Lab	Title	Description	Impact	SDO	Contact	Completed ?
CSTL	Cement and Concrete	NIST consults with ASTM Committee C01 on test methods for cement, concrete, and their ingredients. NIST cement SRMs in the 1880a series support ASTM Standard C 114 for testing of hydraulic cement.	The Cement and Concrete Reference Laboratory (an ASTM research partnership with NIST) uses C 114 and NIST SRMs to qualify all U.S. cement industry labs and many government transportation labs for analyses of cement and concrete.	ASTM International	John Sieber	Ongoing
CSTL	Metals, Ores, and Related Materials	NIST participates in the activities of ASTM Committee E01 under an MOU guiding the development of SRMs for the mining and metals industries.	Standards development and related SRMs improve the quality of metals and alloys used in aerospace, transportation, defense, electronics, human health and safety, and many other applications.	ASTM International	John Sieber	Ongoing
EEEL	Supply chain communication standards	NIST has been instrumental in efforts to develop Product Data Exchange (PDX), RosettaNet interchange specifications (clusters 2 and 7), and Computer-Aided Manufacturing Exchange (CAMX).	Standards support shop floor integration of equipment from different manufacturers and support supply chain communication. These standards are now used in hundreds of thousands of monthly business transactions.	IPC RosettaNet	Barbara Goldstein, John Messina	Yes
EEEL	Broadband (WiMax) Wireless Standards	NIST has been at forefront of developing common open standards for the emerging broadband wireless network technologies. 12 standards projects have been completed with 5 more in development. The standards are widely supported in Asia, and Europeans have elected to follow 802.16. The 802.16e standard (2/06) was major achievement to support mobile terminals	The development of these standards advances the prospects for U.S. technology developers and promotes opportunities for greater access to broadband services. Very broad and fast adoption. Four of the standards were in the top 100 list of IEEE downloads for March 2006. The WiMax Forum with over 350 members was established to promote and certify broadband wireless products.	IEEE (2004) ITU (2006)	Roger Marks	Yes

Lab	Title	Description	Impact	SDO	Contact	Completed ?
EEEL	Restriction of Certain Hazardous Substances in Electronic Products (ROHS)	NIST was instrumental in facilitating the development of a Materials Declaration Management standard (consisting of UML model, XML schema and 2 interactive PDF forms) necessary for U.S. companies to show compliance with an EU directive, which bans electrical products exceeding the specified threshold amounts for 6 hazardous substances used in electronics.	Any company that sells an electrical product in EU member nations after 7/1/06 must declare the hazardous content information. NIST work is assisting U.S. industry to stay competitive in Europe, and has promoted information exchange between large and small firms.	IPC (2006) (also iNEMI)	Eric Simmon	Yes, also ongoing
EEEL	Electromagnetic compatability (EMC)	NIST provides technical leadership in developing standards and improving the measurement methodologies. NIST assists companies to better conduct electro-magnetic measurements by developing alternative EMC test methods.	EMC standards are important for the domestic and export electronics industry. NIST is helping to harmonize U.S. and international standards to reduce the compliance burden on U.S. industry. Informal reports from an aircraft manufacturer suggest that NIST-developed reverberation techniques (implemented in large hangars) alone will at least halve EMC test time for production airliners saving several hundred thousand dollars for each plane tested.	ANSI SAE CISPR IEC	Perry Wilson	Yes, also ongoing
EEEL	Superconductivity Standards	NIST has led IEC's superconductivity standards efforts leading to the first IEC international standard on superconductivity (1998). 13 standards in total have been developed plus one standard on terms and definitions. Inter-laboratory comparisons are ongoing for future standards.	By encouraging international participation in the standards process, NIST has helped U.S manufacturers be competitive in a market dominated by Europe and Japan. MRI is the largest commercial user of superconductivity, and demonstration projects are happening in power grids.	IEC (1998)	Loren Goodrich	Yes, also ongoing

Lab	Title	Description	Impact	SDO	Contact	Completed ?
EEEL	Performance standards for metal detectors	NIST/OLES developed new standards for metal detectors used in concealed weapon and contraband detection, along with evaluation and testing criteria and user guides to facilitate implementation.	New standards were used to define requirements for testing of detectors at airports. Standards in use by FAA, TSA and Bureau of Prisons have contributed significantly to the security of U.S.	NIJ (2000) IPC	Nick Paulter	Yes, also ongoing
EEEL/TS	Performance standards for body armor	NIST/OLES was key driver in developing standard for Ballistic Resistance of Personal Body Armor standard adopted by NIJ. Standard specifies minimum performance requirements and associated test methods. The body armor program is part of NIJ's successful Law Enforcement and Corrections Standards and Testing Program, through which companies may have their products voluntarily certified as compliant with the standard.	Ballistic-resistant body armor meeting NIST-developed performance standards has been credited with saving more than 2500 lives. The Bulletproof Vest Partnership is key stakeholder. Since 1999, over 11 900 jurisdictions have participated in the BVP Program, with $173 million in federal funds committed to support the purchase of an estimated 450 000 vests.	NIJ (2001 most recent) ASTM	Kirk Rice / Gordon Gillerman	Yes, also ongoing
EEEL	Standard Test Methods for MEMS	NIST did pioneering standards work in developing the first standard test methods for MEMS in 2002, with validating round robin studies for these standards completed in 2005. New MEMS/NEMS standards are currently being developed.	MEMS industry has suffered from a lack of standardization. This will allow manufacturers to confirm good performance of products and facilitate international commerce in MEMS.	ASTM (2002, 2005	Janet Marshall	Yes, also ongoing

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EEEL	Land-mobile radio interoperability standards	NIST/OLES has been very involved in supporting development of interface standards since 2005 (Project 25). Four of a total of 8 interface standards have been completed. OLES is working to develop a P-25 compliance assessment program.	Allows for better communication amongst law enforcement officials and first responders. Secretary Chertoff made positive comment. Public safety agencies are requiring the new standards in RFPs, but still need 12-18 months to measure impact.	TIA (2005) (3 new standards in past 15 months)	Derek Orr	In progress
EEEL	Flat panel display standards	NIST developed the Flat Panel Display Measurements Standard offered by the Video Electronics Standards Association (VESA). The FPDM is a display-metrology document that serves industry and other standards organization by providing detailed measurement methods, diagnostics, cautions, and tutorial information to assist those concerned about measuring displays.	These standards support commerce and use of flat panel displays by U.S. industry, which is the largest worldwide end consumer of displays.	ISO, VESA, ANSI-Human-Factors-Society Standard, IEEE, and Society of Motion Picture and Television Engineers (SMPTE).	Paul Boynton	Yes, also ongoing
EEEL	Optical fiber telecommunications	NIST provided technical leadership and evaluations for a number of measurement standards related to optical fiber and instrumentation (power meters, optical spectrum analyzers, etc.)	This work resulted in numerous documentary standards, round robin evaluations, and SRMs that accelerated the adoption of optical fiber communications.	TIA FO-4 IEC TC86	Tim Drapela	Yes, and ongoing
EEEL	High-Frequency Dielectric Measurement Standard	NIST performed the necessary metrology and theory to develop the split-post method to the point of industry acceptance and a standard measurement method	As frequencies of operations of microelectronics increases, the need for well-characterized measurement methods from 7 to 60 Ghz increases. This method satisfies the need.	IPC 2006 (ANSI, IEC in near-future)	James Baker-Jarvis	Yes

Lab	Title	Description	Impact	SDO	Contact	Completed ?
ITL	Digital Encryption Standard (DES) and Advanced Encryption Standard (AES)	NIST developed DES standard to support electronic transactions and implemented conformance testing. In 1997, NIST announced initiation of the effort to replace DES with a new advanced encryption module, which implements symmetric key cryptography. Implemented as FIPS standards in 2001.	DES was critical in launching the commercial encryption industry. Users realized significant operational efficiencies, and DES was critical to rise of electronic banking. Since introduction of AES, approximately 200 AES products have been approved.	FIPS 46 (1977) 46-3 (1999) 197 (2001)	Mike Hogan	Yes
ITL	Role Based Access Control (RBAC)	Lack of standardization was hampering growth of access control products. NIST supplied infrastructure tools to support industry and provided demonstrations of implementations.	NIST's involvement accelerated RBAC by 1 year and lowered R&D costs for software vendors by 6 percent. RTI estimates $671 Net Present Value to economy. Previously studied by Program Office.	INCITS 359 (2003)	Mike Hogan	Yes
ITL	Biometrics	This is an umbrella category covering a number of standards initiatives. NIST/ITL is a major contributor to the national and international biometrics programs by providing leadership for the two standards bodies (INCITS M1 and JTC 1 SC 37), by chairing development of biometric application profiles through these SDOs, and by providing technical editors and a number of technical experts to both SDOs. INCITS, as well as JTC 1 SC 37, are approaching completion of the first generation of biometric data interchange formats for a number of biometric modalities and other biometric standards. Fifteen American National Standards and ten International standards have been published to date.	Many of the first generation of data interchange format standards have already been adopted by large users of personal authentication applications ranging from financial transactions to visitor authentication in amusement parks. Examples of adoption include DHS's adoption of the face recognition standard (INCITS 385) and INCITS 383 (Information technology - Application Profile - Interoperability and Data Interchange - Biometric Based Verification and Identification of Transportation Workers) for the TWIC program. Please see end-notes[i]	INCITS ISO/IEC	Fernando Podio	Many projects completed, but much work still ongoing

Lab	Title	Description	Impact	SDO	Contact	Completed ?
ITL	BioAPI Conformance Test Suite (CTS)	NIST's biometric standards program provides leadership to national and international biometric standards bodies. A key achievement is the development of the BioAPI CTS implementation also known as the Biometric Test Environment.	The BioAPI CTS provides a test methodology for biometric product developers. The biometric industry is growing rapidly in response to homeland security and commercial needs. Over 30 vendors claim products conforming with BioAPI.	INCITS 358	Fernando Podio	Yes
ITL (other labs contribute)	Health informatics	This is an umbrella category covering a number of standards initiatives. NIST works with industry, government and trade groups to develop metrics to demonstrate software interoperability and conformance to particular standards. Specific activities include: standards harmonization; performance and conformance metrics for HIT; guidelines for telemedicine; and security related activities. NIST has interagency agreement with the ONC.	All anticipated benefits: - consumers can move seamlessly between practitioners; - clinicians have information needed at point of care; - payers benefit from economic efficiencies; - public health benefits; and - less medical errors. (Note: Can expand on individual activities but still early for measuring impact.)	HITSP/ANSI IEEE HL7	Lisa Carnahan	No
ITL	XDS (cross-enterprise document sharing)	This is a component of NIST's overall health informatics effort. NIST was instrumental in developing the ebXML registry standard and now supports IHE in developing their XDS profile that integrates ebXML standard into the health care environment. Also developed a test environment used in IHE Connectathons. Ver 2.1 of standard became ISO 15000.	XDS will be a component of the technical infrastructure for electronic health records. Four large commercial vendors have demo versions and some CCHIT contractors are planning to include in their deliverables. 500 downloads of open source implementation. Expect products and installed based by 2007.	OASIS (2000) ISO	Bill Majurski	Yes (but extensions still being developed)

Lab	Title	Description	Impact	SDO	Contact	Completed ?
ITL	XML Technologies	This is an umbrella category covering a number of Web-based standards, including: XML, XSLT, XSL-FO, DOM, XML Schema and XML Query. NIST is a major contributor to the development of conformance tests for these standards.	NIST tests ensure that XML implementations are accurate and interoperable, providing the foundation for the expansion and widespread use of XML in electronic commerce and enterprise systems. NIST tests have resulted in bug fixes to implementations and corrections to the XML specifications.	W3C	Carmelo Montanez	Yes (but tests for new standards are being developed)
ITL	Voting Systems	In response to the 2002 Help America Vote Act (HAVA), NIST is providing technical expertise and developing voting system guidelines and standards including a uniform set of open tests to replace existing proprietary tests for federal certification. HAVA requires NIST to evaluate testing labs and make recommendations for accreditation.	This will reduce security vulnerabilities and voting system errors and increase voter confidence while maintaining reasonable costs and increasing usability and accessibility to all voters. The first set of testing labs certified in January 2007.	ANSI IEEE Access Board	Mark Skall, John Wack	No
ITL	Personal Identity Verification (PIV)	In response to Homeland Security Presidential Directive-12, NIST developed FIPS 201and supporting special publications, which specify architecture and requirements for a common ID standard for federal employees and other eligible personnel. The PIV card supports multiple-factor authentication and is to be used for control of both physical access to federal facilities and control of logical access to many federal information systems.	Agencies must begin to implement in Oct 2006. Federal smart card market is estimated at approx $6B. Smart card industry is lining up to develop products. Standard will improve security of physical and logical assets and reliability of federal identification credentials. Beginning to replace Eauthentication for internal agency applications. Full implementation required by end-2008. Being considered for use by local and state government use.	FIPS 201 (2005)	Bill MacGregor	Yes

Lab	Title	Description	Impact	SDO	Contact	Completed ?
ITL	ISO/IEC 24727: Identification cards – Integrated circuit card programming interfaces	Development of a multi-part international standard based on NISTIR 6887. Provides interfaces and application programming interfaces for interoperable use of integrated circuit cards. Dedicated ISO/IEC task force for this work chaired by NIST.	Removal of U.S. barriers to smart card adoption. Solves known technical barriers to interoperable use of integrated circuit cards, in particular as related to identity credentials, such as the Federal PIV card. Receiving world-wide attention, as evidenced by early adoption by the European Union and Australia. Improves reliability and portability of security identity credentials; opens markets for U.S. API providers; and reduces cost of software development.	ISO/IEC JTC 1 SubCommittee 17	Teresa Schwarzhoff	Part 1: IS 2006 Part 2: IS 2007 Part 3:IS 2008 Part 4: IS 2008 Part 5: IS 2008, 2009
ITL	National technical report: ISO/IEC 24727	Describes the interworking of two integrated circuit card applications on the same card using the ISO/IEC 24727 series of standards. The two card applications used are the U.S. Government's Personal Identity Verification (PIV) card application as described in NIST SP 800-73 and the Fare Payment Card application as described in the INCITS Interoperability Framework for Contactless Fare Payment Technologies and Systems documents. National Task Group responsible for this body of work Chaired by NIST.	Improves U.S. contributions to ISO/IEC 24727 standards to ensure compatibility with U.S. federal standards. Improves commercialization of ICC and related support products. Improves quality of service delivery with identity credentials tokens.	ANSI/INCITS B10	Teresa Schwarzhoff	Fall 2007

Lab	Title	Description	Impact	SDO	Contact	Completed ?
ITL	Cryptographic Testing Module	NIST developed standard. Crypto Module Validation Program created in conjunction with Canadian authorities. FIPS 140-2 has become defacto international standard. Want convergence with FIPS 140-3 and ISO 19790.	FIPS 140-2 recognized by governments worldwide. Very successful validation program.12 CMVP labs have been accredited. Over 675 certificates (for 1200 modules) have been provided to over 100 different vendors.	FIPS 140-2 (2001) ISO (2006 – but some U.S. specific items removed)	Randy Easter	Yes
ITL	MPEG-7	The MPEG-7 standard also known as "Multimedia Content Description Interface" aims at providing standardized core technologies allowing description of audiovisual data content in multimedia environments. This technology is being designed by a range of experts including content creators, broadcasters, manufacturers, publishers, intellectual property rights managers, telecommunication service providers, academia, government, etc. NIST is a major contributor for the MPEG-7 Interoperability Testbed (M7ITB); provides validation tools for MPEG-7 technology; and is the main editor for creation of MPEG-7 profiles and levels for various MPEG-7 application domains. MPEG-7 metadata descriptions are the basic building block to describe audiovisual content so that search engines can index, search, and retrieve in a more effective and efficient way.	NIST M7ITB validator ensures that MPEG-7 description instances are accurate according to the standard specification and interoperable across various vendor implementations. It provides the validation on MPEG-7 schemas and conformance testing on MPEG-7 instances. This technology is applicable for wide spectrum of applications such as: • Broadcast media selection (e.g., radio and TV channel); • Digital libraries (e.g., film, image, video and radio archives); • E-Commerce (e.g., advertising, directories of e-shops); • Education (e.g., multimedia courses, on-line training); • Home Entertainment (e.g. home video, game, karaoke); and • Multimedia directory services (e.g. yellow pages, tourist information).	ISO/IEC SC29 WG11	Wo Chang	Yes

Lab	Title	Description	Impact	SDO	Contact	Completed ?
ITL	Software engineering: Software product Quality Requirements and Evaluation (SquaRe) – Common Industry Format (CIF) for Usability Test Reports	CIF provides a standard method for reporting usability test findings. The format is designed for reporting results of formal usability tests in which quantitative measurements were collected and is particularly appropriate for summative/comparative testing. The CIF does not indicate how to perform a usability test but provides guidance on how to report the results of a usability test. The CIF targets two audiences: usability professionals and stakeholders in an organization. Stakeholders can use the usability data to help make informed decisions concerning the release of software products or the procurement of such products.	Vendors and procurers of software systems now have quantitative data on which to base decisions regarding the usability of a product. Raised the visibility of usability of software systems for procurement.	ISO 25062:2005	Mary Theofanos	Yes
MEL	Standard for the Exchange of Product Model Data (STEP)	Previously well-documented study. STEP suite of standards enables manufacturing companies to exchange digital representations of engineering and manufacturing data. MEL believes revisions, extensions to the standard, and work on testing methodologies still make this relevant. First 12 parts of STEP approved as international standards in 1995. 30 parts approved by 2002, and many more since then.	NPV over $1 billion calculated in previous study. Allows for long-term data archiving. Being used in most key complex manufacturing industries such as automotive, aerospace and ship building. For example, Lockheed plans to use STEP across all new aircraft programs with first tier suppliers and has documented their savings on the F-16 program.	ISO (1995)	Steve Ray	Yes

Lab	Title	Description	Impact	SDO	Contact	Completed ?
MEL	Inventory visibility and interoperability	NIST was requested by AIAG to develop a common interface specs and test some OAG standards. Tested multi-tier supply chain standards in auto industry where lack of interoperability costs $1 billion annually. Focused on dimensional metrology systems.	AIAG study shows that implementing NIST/AIAG recommendations from testing study will result in cost avoidance of $197 million and net savings of $255 million.	OAG	Steve Ray	Yes (almost)
MEL	Integrated Sensor Network (RFID)	MEL is working on developing standards for integrated sensor networks containing RFID. Standard still under development.	Industry is looking to incorporate wireless comms into their products and processes. No impact to measure at this time.	IEEE	Kang Lee	No
MSEL	Charpy Program	Test of brittleness/ductility and impact energy for metals. NIST had instrumental role. Working to harmonize with ISO.	Written into numerous specs. around the world. Key quality test in used in metal contracts. Largest selling Standard Reference Material in MSEL.	ASTM (1970s) ISO	Chris McGowan/Tom Siewert	No (ISO harmonization effort still ongoing)
MSEL	Ceramic Mechanical Properties and Specifications	MSEL had lead role in developing standards for hip-joint ceramic balls and ceramic ball bearings.	ISO 14705 adopted in 2000. Hip-joint has significant health care impact, and ball bearings have large impact on manufacturing.	ASTM ISO (2000)	George Quinn	No
MSEL	Ceramic Armor	NIST developed test method standards and SRMs used by U.S. Army to characterize materials.	Saves warfighter lives.	ASTM	George Quinn	Yes

Lab	Title	Description	Impact	SDO	Contact	Completed ?
MSEL	Rockwell Hardness Test (steel)	NIST was instrumental in the research to establish a traceability system for hardness measurements, developing SRMs and is refining test methods. NIST has most accurate hardness machine in U.S. A laboratory accreditation program is under development.	Huge impact on trade of metals. Establishes national chain of traceability to fundamental SI units. Disputes between producers and users curtailed.	CIPM, ASTM, ISO	Sam Low	Yes (except laboratory accreditation program)
MSEL	Knoop Test	Hardness test invented at NIST (Knoop method) adapted for advanced ceramics.	To be written into USA tariff schedule and under negotiation within NAFTA for items such as ceramic wares for technical uses, kitchen and bath products, and porcelain and china.	ASTM, ISO	George Quinn	Yes
MSEL	Instrumented Indentation Testing	Standard practice and test methods for instrumented indentation provide first reliable basis for quantitative mechanical property determination for thin films and coatings.	Provides the first basis for product specifications related to coating and thin film hardness and elasticity. Relevant to microelectronics and MEMS components, wear coatings for cutting tools, scratch-resistant optical (eyeglass) coatings, automotive paints, etc.	ISO, ASTM	Douglas Smith	ISO: Partial. ASTM – No.
MSEL	Test Methods for Embedded Passive Materials	Master IPC standard TM -650, Test Methods Manual has been expanded with new tests to Determine Permittivity and Loss Tangent of Embedded Passive Materials at High Frequencies. Also a new specification for Capacitor Materials IPC 4821 has been adopted.	New test procedures and specifications are having a major impact on Embedded Passive Electronic materials for wireless communications components and military devices where miniaturization is critical. Improved reliability.	IPC (2005, 2006)	Jan Obrzut	Yes, and ongoing

Lab	Title	Description	Impact	SDO	Contact	Completed ?
PL	Standard Practice for Obtaining Colorimetric Data from a Visual Display Unit Using Tristimulus Colorimeters	This standard (ASTM E1455-03) adopted the method developed by NIST researchers and also drafted by a NIST researcher. This standard prescribes the method for measuring chromaticity of displays accurately using tristimulus colorimeters, with computational corrections for errors introduced by imperfect matching of spectral responsivity of the detectors. This method can be applied to measurement of any RGB based color displays.	This standard is helping improve the measurement accuracy for color displays and thus contributing to efficient production, commerce, and quality of display products. Tristimulus colorimeters are widely used in the display industry, but the accuracy has been a problem. This method corrects the errors. It is being used in some commercial products.	ASTM (2003) CIE	Yoshi Ohno	Yes
PL	Approved Method for Total Luminous Flux Measurement of Lamps Using an Integrating Sphere Photometer	This standard (IESNA LM-78-2006) was drafted by a NIST researcher, and NIST played the leading role in developing this standard. This standard provides recommendations on how to use integrating sphere photometers for accurate measurement of total luminous flux (lumen) of light sources, including design of integrating spheres, recommended sphere geometry, measurement procedures, correction methods, and uncertainty analysis. This document is to be referenced in many other IESNA LM standards.	This standard will help improve the measurement accuracy of total luminous flux (lumen) in lighting industry, thus contributing to efficient production, commerce, and quality of lamp products. This standard is to be referenced by accreditation program for Energy-Efficient Lighting products, and all lamp manufacturers will follow the practice given in this standard.	IESNA (2006)	Yoshi Ohno	Mostly

Lab	Title	Description	Impact	SDO	Contact	Completed ?
PL	Standards on Solid-State Lighting Products	NIST is playing leading role in developing ANSI and IESNA standards for solid-state lighting (SSL). NIST has made major contributions to "IESNA Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products (LM-79)," which is being finalized. This standard provides recommended methods for total luminous flux, luminous efficacy (lm/W) and color measurement of SSL products. NIST is also playing major role in developing ANSI standard for color specifications of SSL products.	These standards will facilitate development and commercialization of SSL products, which DOE is promoting to accelerate huge energy savings for the nation. For example, the color specifications will have a large impact on future directions for development of white LEDs and SSL products. LM-79 will provide guidance to SSL industry on accurate photometric measurements of their products and be part of the new DOE ENERGY STAR specification for solid state lighting Luminaires.	ANSI IESNA (2007)	Yoshi Ohno	Still in progress.
PL	Radiation Detector Certification (Rad-Nuc)	NIST was driving force behind the development of 4 standards (N42.32-35) related to radiation detector certification for four classes of detectors from hand-held instruments to monitors used for trucks to cargo containers. The team also has developed test and evaluation protocols to be used for testing these instruments.	These standards and the associated testing will help improve public safety by addressing performance of detection equipment used in border control, customs, coast guard and postal services and their need for detection of illicit radioactive materials and response to terrorist threats. This work is recognized by DHS as a model for gov't/private sector development of standards for homeland security.	IEEE /ANSI (2003)	Mike Unterweger	Yes (other related standards still being developed)

Lab	Title	Description	Impact	SDO	Contact	Completed ?
PL/TS	X-Ray Security Screening Systems	NIST is leading a program to develop 4 technical performance standards (ANSI N42.44-47) related to the image quality of x-ray security screening systems for cargo, computerized tomography (for checked baggage), checkpoint and body scan. These standards will include test methods, test artifacts, and minimum performance requirements where this does not compromise security sensitive information.	These standards will be used by DHS and state and local governments to insure that only systems that meet satisfactory levels of performance will be purchased and used in the nation's aviation security venues, public buildings and events, and screening at ports, borders, and prisons.	IEEE /ANSI (2007)	Larry Hudson	No, in development

[i] The Registered Travel Interoperability Consortium Technical in its "Interoperability Specification" (not yet officially adopted by TSA) identifies the following standards to be utilized in the RT Program: INCITS 378 (Finger Minutia Format), INCITS 385 (Face Image Format Standard), INCITS 398 (Common Biometric Exchange Framework Format (CBEFF) – CBEFF PIV Patron Format and ISO/IEC 19794-6, Iris Image Format. DoD IT Registry includes a number of INCITS standards including INCITS 358-2002, BioAPI specification, INCITS 398-2005 (CBEFF), INCITS 377 Finger Pattern Format, INCITS 378 Finger Minutiae Format, INCITS 379 Iris Image Interchange Format, INCITS 381 Finger Image Based Interchange Format and INCITS 385 Face Recognition Format.

Internationally, ICAO requires for Machine Readable Travel Documents conformance to ISO/IEC 19794-5 (Face Image Format) and also ISO/IEC 19794-2 (Finger Minutia Data), ISO/IEC 19794-4 (Finger Image Data), ISO/IEC 19794-6 Iris Image data and ISO/IEC 19785 (CBEFF). These standards were developed by ISO/IEC JTC 1 SC 37. The International Labour Office of the UN for their Seafarer's ID Card requires conformance to ISO/IEC 19794-2, -4 and ISO/IEC 19785 (CBEFF). The initial CBEFF specification was published as NISTIR 6529-A, fast tracked through INCITS as an American National Standard (INCITS 398:2005) and proposed to ISO/IEC JTC 1 SC 37 as a draft international standard.