SUPPLEMENTAL REPORT

Department of Commerce, Annual Budget Proposal, FY 2009

Annual Report on Technology Transfer: Approach and Plans, FY 2007 Activities and Achievements

U.S. Department of Commerce

Report prepared by:

National Institute of Standards and Technology

National Oceanic and Atmospheric Administration

Institute for Telecommunication Sciences, National Telecommunications and Information Administration

In response to the:

Technology Transfer and Commercialization Act of 2000 (P.L. 106-404)

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Foreword. This is the calendar year 2008 edition of a report series summarizing the technology transfer activities and achievements of the Department of Commerce's federal laboratories. This report responds to the statutory requirement for an annual "agency report on utilization" [15 U.S.C. Section 3710 (f)] under the revised federal-wide reporting process established by the Technology Transfer Commercialization Act of 2000 (P.L. 106-404). All federal agencies that direct one or more federal laboratories or conduct other activities under Section 207 and 209 of Title 35, United States Code are subject to the requirements of this statute.

At the Department of Commerce, technology transfer is a part of the mission and program activities of principally the National Institute of Standards and Technology (NIST), the National Oceanic and Atmospheric Administration (NOAA), and the Institute for Telecommunication Sciences (ITS) within the National Telecommunications and Information Administration (NTIA). Accordingly, this report focuses on the activities of these three agencies.

Each of the major sections of this report is organized to summarize the agency's technology transfer approaches and plans and to provide specific information about the activities and accomplishments for FY 2007 and several earlier comparative years. The report begins with a summary of this information for the Department of Commerce as a whole.

This report has been organized and prepared with the joint participation of technology transfer personnel at NIST, NOAA, and ITS.

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I. DEPARTMENT OF COMMERCE OVERVIEW

Technology Transfer by the Department's Federal Laboratories – Summary of Approaches and FY 2007 Activities and Achievements

The Department of Commerce works in partnership with businesses, universities, communities, and workers to promote innovation and the Nation's overall competitiveness in the global economy. The department pursues this objective through a host of policy and program activities directed at strengthening the nation's economic infrastructure, facilitating the development of cutting-edge science and technology, providing an information base, and managing national resources.

At the Department, research and development (R&D) in numerous areas of contemporary science and technology is conducted at the National Institute of Standards and Technology, National Oceanic and Atmospheric Administration (various lab facilities across NOAA's bureaus), and the Institute for Telecommunication Sciences within the National Telecommunications and Information Administration. Technology transfer is a key part of the program activities at each of these agencies' federal lab systems.

■ Agency Missions and Channels for Technology Transfer

Mission	Tech Transfer
NIST NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life. NIST laboratories develop and disseminate measurement techniques, reference data, test methods, standards, and other infrastructural technologies and services that support U.S. industry, scientific research, and the activities of many federal agencies. In carrying out its mission, NIST works directly with industry partners (and consortia), universities, associations, and other government agencies.	▪ The general focus of NIST's technology transfer activities is the broad dissemination of research results to industry, rather than just the creation of patents and associated licenses. Accordingly, NIST draws on a diverse group of mechanisms to transfer the knowledge and technologies that result from its laboratory research. ▪ Principal tech transfer mechanisms: Technical publications, Standard Reference Materials, Standard Reference Data, Calibration services, Documentary standards, CRADAs, Patents and licenses, Conferences, workshops, and inquiries, Guest researchers and facilities users.

Mission	Tech Transfer
NOAA NOAA's mission is to understand and predict changes in the Earth's environment and conserve and manage coastal and marine resources to meet the Nation's economic, social, and environmental needs. This mission will become ever more critical in the 21st century as national needs intensify concerning climate change, freshwater supply, ecosystem management, and homeland security.	▪ NOAA's broad approach to tech transfer involves direct transfer, licensing intellectual property, and cooperative research relationships with industry. ▪ Principal tech transfer mechanisms: Public dissemination, CRADAs, Patents and licenses.
ITS ITS is the chief research and engineering arm of the National Telecommunications and Information Administration (NTIA). ITS supports such NTIA telecommunications objectives as promotion of advanced telecommunications and information infrastructure development in the United States, enhancement of domestic competitiveness, improvement of foreign trade opportunities for U.S. telecommunications firms, and facilitation of more efficient and effective use of the radio spectrum. ITS also serves as a principal federal resource for solving the telecommunications concerns of other federal agencies, state and local governments, private corporations and associations, and international organizations. ITS uses three principal means for achieving technology transfer: cooperative research and development, technical publications, and leadership and technical contributions in the development of telecommunications standards.	▪ ITS participates in tech transfer and commercialization by fostering cooperative research with industry where benefits can directly facilitate U.S. competitiveness and market opportunities. ▪ Principal tech transfer mechanisms: CRADAs, Patents and licenses, Telecommunications analysis services, Technical publications, Development of telecommunications standards.

■ Summary of Technology Transfer Activities and Achievements across the Department, FY 2007 and Recent Years

■ *Selected Activity Measures*

Agency-Specific Important Mechanisms for Technology and Knowledge Transfer

		FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
Standard Reference Materials (SRMs) available	NIST	1,214	1,211	1,246	1,302	1,285
Standard Reference Materials (SRMs) sold	NIST	29,527	30,490	32,163	31,195	32,614
Standard Reference Data (SRD) titles available	NIST	106	95	110	113	109
Number of calibration tests performed	NIST	13,987	12,503	12,849	13,127	27,489[1]
Technical publications in peer-reviewed journals	NIST	NA	1,070	1,148	1,163	1,272
Journal articles published	NOAA	626	419	397	444	572
Technical reports published	NOAA	245	300	226	148	176
Technical publications produced	ITS	20	17	19	8	3

(1) This number of tests is significantly different from the usual annual average of 13,000 principally due to a surge in calibration testing performed for the military and its contractors in the fourth quarter of FY2007.

Collaborative Relationships for Research & Development

		FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● **CRADA**s, total active in the FY						
▪ Traditional CRADAs						
	Department	92	67	80	149	154
	NIST	76	51	65	135	140
	NOAA	11	9	8	6	5
	ITS	5	7	7	8	9
▪ Non-traditional CRADAs						
	Department	1,811	1,902	1,826	2,895	2,510
	NIST	1,577	1,590	1,553	2,353	2,348
	ITS	234	312	273	506	276
● **Other types of collaborative R&D relationships**						
▪ NIST Facility use agreements		511	590	588	639	998
▪ NIST Guest scientists and engineers		1,300	1,700	2,115	2,114	2,672
▪ ITS Collaborative contributions		2	11	11	16	25

Invention Disclosure and Patenting

		FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● New inventions disclosed in the FY	Department	21	25	23	14	32
	NIST	16	23	19	10	29
	NOAA	5	2	1	4	3
	ITS	0	0	1	0	0
● Patent applications filed in the FY	Department	5	8	6	5	7
	NIST	5	8	5	4	6
	NOAA	0	0	1	0	1
	ITS	0	0	0	1	0
● Patents issued in the FY	Department	9	11	10	7	4
	NIST	7	10	9	6	3
	NOAA	1	1	1	0	1
	ITS	1	0	0	1	0

Licensing -- Profile of Active Licenses

		FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● All DOC licenses, active in FY		101	125	133	110	147
Patent licenses	Department	101	30	33	35	41
	NIST	39	22	26	23	25
	NOAA	5	5	4	5	6
	ITS	57	3	3	7	10
Other invention licenses	ITS	0	95	100	75	106

Characteristics of Licenses Bearing Income

		FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● **All income bearing licenses**, number	Department	37	23	25	30	35
▪ **Invention licenses**, income bearing	Department	37	23	25	30	35
- Patent licenses	Department	37	23	25	30	35
	NIST	29	15	17	18	21
	NOAA	5	5	4	5	4
	ITS	3	3	4	7	10
▫ Exclusive/ partially exclusive/ non-exclusive	Department	20/0/17	11/0/12	12/0/13	17/0/13	16/0/19
	NIST	19/0/10		11/0/6	16/0/2	16/0/5
	NOAA	1/0/4	10/0/5	1/0/3	1/0/4	0/0/4
	ITS	0/0/3	0/0/3	0/0/4	0/0/7	0/0/10

Income from Licensing

		FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● **Total income**, all licenses active in FY		$127,56	$203,28	$146,66	$194,39	$224,84
	Department	$127,56	$203,28	$146,66	$194,39	$224,84
	NIST	$122,85	$144,82	$123,34	$156,79	$195,34
	NOAA	$4,716	$24,961	$16,100	$13,100	$22,000
	ITS	$0	$33,500	$7,212	$24,500	$7,500

Further detail on the measures cited in the tables above, as well as additional activity statistics can be found in the individual agency chapters later in this report.

■ The Department's Performance Metrics for Technology Transfer

This year's annual report again provides a comprehensive set of statistics on the technology transfer activities of each of the department's agencies with federal lab operations. This information covers cooperative research and development relationships, invention disclosure/patenting, licensing, and other technology transfer mechanisms employed by the labs. There is also a new round of agency-selected case illustrations of downstream outcomes (e.g., commercially significant technologies) resulting from these federal lab technology transfer activities.

The content and format of this year's performance report is consistent with guidelines issued for the annual performance reporting by the Office of Management and Budget in its July 2007 edition of Circular A-11. (OMB's guidelines draw closely from the performance reporting approach organized by the Interagency Working Group on Technology Transfer -- which is coordinated by the Department of Commerce. This approach has been the basis for the Department of Commerce's and other agencies' reporting over the last several years.)

All of the agencies continue to indicate that their overall technology transfer effort involves a good deal more than cooperative R&D, patenting, and licensing. These "other" mechanisms include transfer through technical publications, development of industrial standards, other forms of public dissemination, and opportunities for guest scientists and engineers to participate in federal lab activities. Each of the agencies now includes yearly activity figures for such "other" mechanisms as they are a part of the agency's technology transfer effort.

Plans for technology transfer activities by the Department of Commerce's federal labs generally continue to emphasize the development of better metrics for program performance. In general, a stable framework for this annual reporting has now been established and is comprehensive of the main technology transfer mechanisms used by the Department's labs. The Department continues, however, to evaluate the effectiveness of its technology transfer activities and will consider including additional metrics. Specific initiatives underway at each agency are described in Sections II, III, and IV.

II. NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

Technology Transfer at the Agency's Federal Laboratories – Approach and Plans, FY 2007 Activities and Achievements

II.1. Agency Approach and Plans for Technology Transfer

The National Institute of Standards and Technology (NIST) has a broad mission – to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards and technology in ways that enhance economic security and improve our quality of life.

An essential part of NIST's work is to anticipate the future measurement and standards needs of U.S. industry. Fast-moving sectors like nanotechnology, biotechnology, homeland security, information technology, and advanced manufacturing need sophisticated technical support systems to flourish and grow. NIST's laboratories develop and disseminate measurement techniques, reference data, test methods, standards, and other infrastructural technologies and services that support U.S. industry, scientific research, and the activities of many federal agencies. In carrying out its mission, NIST works directly with industry partners (individual companies and consortia), universities, associations, and other government agencies.

NIST's technology transfer activities are designed to disseminate the Institute's measurements and standards research results broadly to industry and other customers. Leading-edge scientific and technical work requires multiple disciplines, high levels of collaboration among organizations and people with diverse capabilities, and highly specialized facilities and tools. For more than a century, the NIST laboratories have successfully collaborated with industry and universities to provide the measurement techniques and technical tools needed by America's innovators. NIST uses many mechanisms to collaborate with industry and to ensure that the resulting knowledge and infrastructural technologies are broadly disseminated.

The principal technology mechanisms employed for transfer of NIST's intellectual property and assets – in rough order of significance - are: informal research and development collaboration with colleagues from industry, academia and other government agencies; peer-reviewed publications; dissemination of Standard Reference Materials, Standard Reference Data, and Documentary Standards; participation in development of industry "road maps", organizing conferences and workshops; hosting U.S. and international Guest Researchers from industry, academia and other government agencies; Facility Use Agreements; CRADAs; and patents/licenses. NIST also devotes considerable attention to publicizing its planned, ongoing, and recently completed work in the trade and technical press, which is followed by organizations most likely to have an interest in utilizing the results of NIST's work and the agency's research and services.

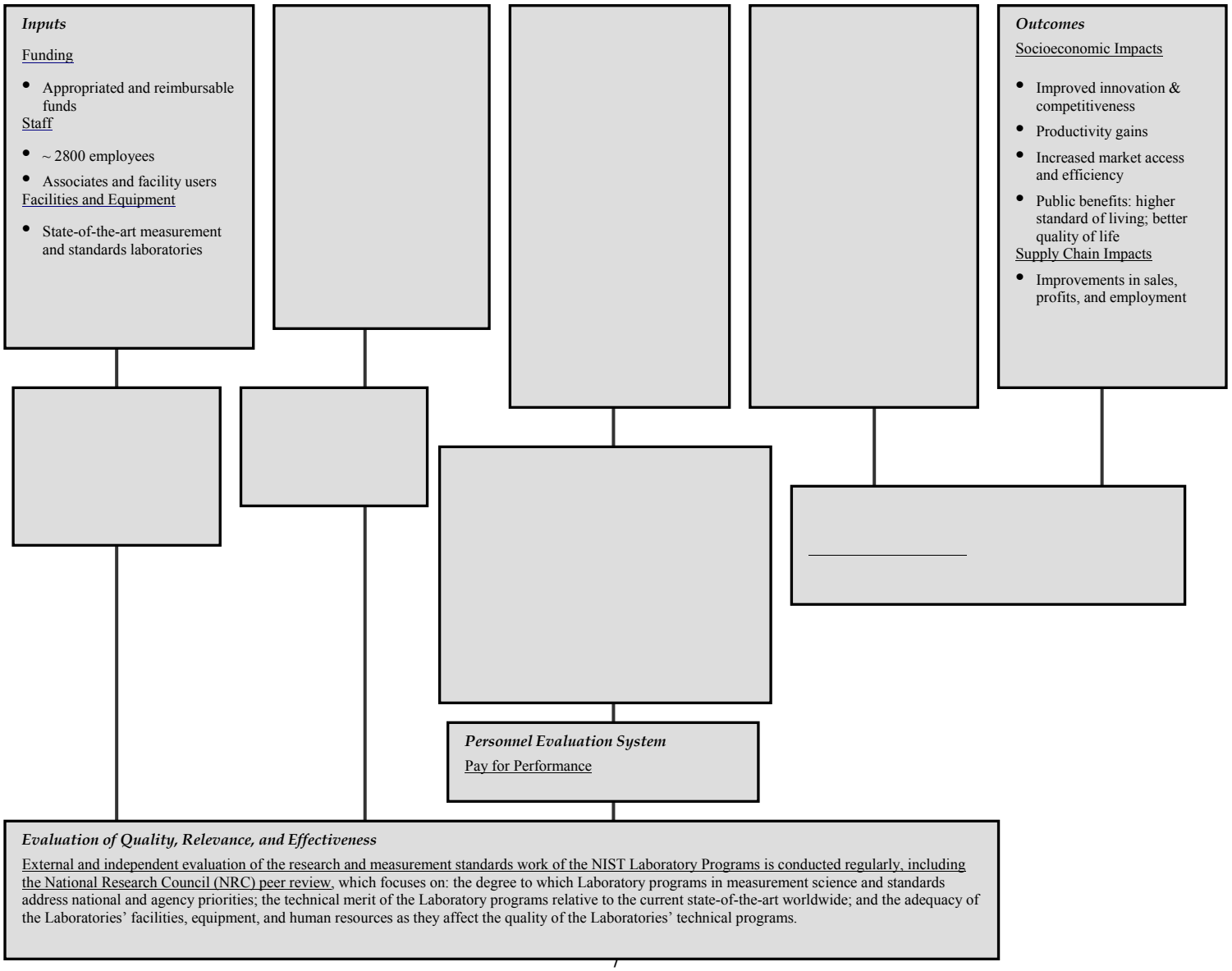
Progress in Improving the Agency's Performance Metrics for Tech Transfer

The present array of metrics covers the wide variety of mechanisms that NIST employs for technology transfer. During FY 2007 NIST implemented substantial improvements in its formal

patent/licensing policies and procedures including the establishment of a Patent Review Committee, formal intellectual property training sessions in both Gaithersburg and Boulder, and a new marketing position in the Office of Technology Partnerships. NIST also brought together a coalition of the private sector, and Federal, State, and local government agencies in a highly successful program to facilitate technology transfer through the Post Doctoral STEM resources serving term appointments in federal laboratories.

Looking forward, in FY 2008 NIST will continue to participate in this program and expand its technology transfer collaborations with regional economic development and venture capital venues as well as through the Manufacturing Extension Partnership (MEP) network which reaches over 10,000 manufacturing entities in the U.S.. Of particular note, in 2008 NIST will designate a portion of the NIST SBIR awards to provide "seed" funding for research leading to commercial development of NIST technology.

NIST Laboratory Program: Impact and Evaluation Logic Model



● Patents and Licensing

In FY 2007, NIST management completed an in-depth review of NIST patent policy and procedures, benchmarked against other federal agencies. As a result of this review, a new Patent Policy and implementing procedures were put in place. The importance of these to the continuing transfer and vitality of NIST research was communicated to the staff by the NIST Director, Operating Unit Directors, and in an ongoing program of informational sessions and meetings led by the Office of Technology Partnerships (OTP). The FY 2007 result was a 200% increase in the number of invention disclosures.

NIST management also established a Patent Review Committee (PRC) to provide patenting recommendations on invention disclosures to Operating Unit Directors. The PRC consists of one member from each of the scientific Operating Units, Technology Services and the NIST Counsel's Office.

In FY 2007 OTP reassigned staff and created an additional position to both provide extra support to NIST staff on patenting and the broad array of collaboration vehicles and to begin a formal program for marketing NIST technologies. The inaugural activity of the marketing program was a presentation of bio-related NIST patents available for license by NIST researchers at a meeting of the Washington area MIT Enterprise Forum in early FY 2008.

In FY 2007 the NIST SBIR Program also initiated an innovative use of SBIR awards to fund further development of NIST innovations by the private sector. Under this initiative, a portion of the FY 2008 NIST SBIR awards will be made to small businesses that have submitted proposals to commercialize NIST technology.

NIST entered into five new patent licenses in FY 2007, including a non-exclusive license to Elia Life Sciences for commercialization of a tactile graphic display and finger tip graphic reader. Licensing revenues increased by 25% through an increased diligence in collecting royalties owed that began in FY 2006.

● Standard Reference Materials

Standard Reference Materials (SRMs) are one definitive source of measurement traceability in the United States. All measurements using SRMs can be traced to a common and recognized set of basic standards that provides the basis for compatibility of measurements among different laboratories. As economic exchange has become more global, customers increasingly use SRMs to achieve measurement quality and conformance to process requirements that address both national and international needs for commerce and trade. NIST produces and disseminates SRMs to a large and diverse group of customers, including private sector laboratories, universities, and other federal agencies. NIST SRMs support industrial materials production and analysis, environmental analysis, health measurements, and basic measurements in science and metrology. The number of SRMs available for sale -- currently 1,285 -- illustrates the breadth of measurements supported by NIST. Over time, NIST expects slight growth in the number of SRMs available, given its current strategy of focusing on those SRMs that cannot be produced by secondary laboratories and which have broad and/or high downstream impact. In establishing its out-year projections, the NIST SRM Program monitors, among other things, trends in emerging technologies, new regulations that will depend on SRMs for enforcement, and the reference material needs of other federal agencies. Several microeconomic studies of NIST SRM programs

have shown the technology transfer mechanisms built into these efforts to be effective with resulting high economic benefits delivered to industry.

● Calibration Services

The NIST laboratories provide physical measurement services for their customers, including calibration services, special tests, and measurement assurance programs (MAPs). Calibration services and special tests are characterizations of particular instruments, devices, and sets of standards with respect to international and national standards. MAPs are quality control programs for calibrating entire measurement systems. NIST's calibration services are designed to help the makers and users of precision instruments achieve the highest possible levels of measurement quality and productivity. The services constitute the highest order of calibration services available in the United States. NIST offers more than 500 different types of physical calibrations covering the following measurement areas: dimensional; mechanical, including flow, acoustic, and ultrasonic; thermodynamic; optical radiation; ionizing radiation; electromagnetic; and time and frequency.

Over the past several years, NIST has performed approximately 13,000 calibration tests annually. This number more than doubled in 2007 due to a surge in calibration testing for the military and its contractors in the fourth quarter of FY 2007. Additionally, over 500 tests were ordered from a single nanotechnology company. Over the next several years, NIST expects to perform a high number of calibration tests with an increasing trend but more in line with its long term annual average. The number of calibrations in individual years may also fluctuate slightly due to multi-year calibration cycles. NIST expects to provide fewer but more highly leveraged calibration services over time. NIST's strategy is driven by the need to effectively manage trends in demand from its major industry and government customers for these services. NIST is pursuing three strategies: (1) performing only those calibrations that require a direct connection to the national standards; (2) improving calibration accuracy in those areas where new industry demands are emerging; and (3) accrediting primary and secondary calibration laboratories to meet on-going industry needs. In FY 2007, the National Voluntary Laboratory Accreditation Program (NVLAP) accepted 2 new calibration laboratories into the program (bringing the total to 74) in fields ranging from dimensional metrology to optical and ionizing radiation. Through laboratory accreditation, NIST efficiently leverages its primary calibration services to support a broader base of secondary calibrations conducted within the private sector.

● Standard Reference Data

NIST produces and makes available (i.e., sells or distributes for free) many Standard Reference Data titles (SRDs). SRDs provide numeric data to scientists and engineers for use in technical problem solving, research, and development. These recommended values are based on data extracted from scientific and technical literature or on measurements done at NIST laboratories, which are then assessed for reliability and evaluated to select the preferred values. NISTs SRD databases cover many areas of science, including analytical chemistry, atomic and molecular physics, biotechnology, and materials sciences. Historically, NIST has produced two new SRD titles per year. At the same time, NIST also provides numerous upgrades to existing databases. In FY 2007 a significant new upgrade to Standard Reference Database 23 - NIST Reference Fluid Thermodynamic and Transport Properties Version 8.0 was completed. Another major innovation this year was the addition of two online data products for fee - NIST WebThermo Tables Lite

and Professional Edition. Because of the addition of these two products, several PC products covering this scientific area were discontinued. At the beginning of FY 2008 there were 109 SRD databases for sale, including the online Web Thermo Tables. Over time, NIST expects continued modest growth in the total number of SRD titles available.

● Technical Publications

NIST uses publications as a key mechanism to transfer the results of its work to the U.S. private sector and to other government agencies that need cutting-edge measurements and standards. Many of these publications appear in prestigious scientific journals and undergo peer review by the scientific community. Others appear in technological forums where measurement standards and technologies developed by NIST staff (at times in collaboration with private sector partners) are disseminated. Of the approximately 2000-2200 technical publications produced annually, about 50-60% appear in prestigious scientific peer-reviewed journals while the remaining 40-50% are in other external publications, such as conference proceedings and NIST series publications. Over time, NIST expects the number of peer-reviewed publications to increase as a function of the American Competitiveness Initiative investment.

● Informal Collaborative Research, Guest Researchers and Facilities Users

Each year hundreds of researchers visit NIST to participate in collaborative projects and/or to use NIST's research facilities. NIST makes its facilities available for limited periods of time to domestic and foreign guest researchers to collaborate with NIST staff on research and development projects of mutual interest or to transfer NIST techniques, procedures, and best practices. NIST also sponsors several formal collaboration programs with universities, among them JILA, an interdisciplinary institute for research and graduate education in the physical sciences, located on the main campus of the University of Colorado (CU) in Boulder, and operated jointly by CU and NIST; the Center for Advanced Research in Biotechnology (CARB), a joint collaboration with the University of Maryland Biotechnology Institute that conducts research and provides interdisciplinary training in fundamental problems at the forefront of biotechnology; the Hollings Marine Laboratory (HML), a collaboration between NIST, NOAA, the South Carolina Department of Natural Resources, the Medical University of South Carolina and the College of Charleston that conducts interdisciplinary scientific research for a better understanding of marine resources and environmental health; and the Joint Quantum Institute (JQI), a collaboration between NIST and the University of Maryland focused on quantum phenomena and their potential applications.

● Conferences, Workshops, and Inquiries

Technology transfer is a "contact sport" -- one of the most important mechanisms for technology dissemination is through communication, education, and interaction among researchers and users of technology. Thus NIST also transfers its technology through the hosting of numerous conferences and workshops, as well as through answering inquiries. During FY 2007, NIST held 69 conferences with about 8,000 attendees.

● Participation in Documentary Standards Committees

Still another means by which NIST transfers technology is through staff participation in the activities of documentary standards developing organizations, which develop consensus

standards on a host of technologies. NIST participation enables its scientists and engineers to bring NIST technology directly into a standard, which could involve test methods and procedures for protecting health, safety, and/or the environment, or specifications for performance or interoperability, or other aspects. During FY 2007, 407 NIST staff members participated on 985 committees representing 109 standards developing organizations. NIST staff held 1,368 memberships on these committees including 389 in ASTM International, 50 in the American National Standards Institute (ANSI), 81 in the Institute for Electrical and Electronic Engineers (IEEE), and 98 in the International Organization for Standardization (ISO). These activities are also reported by NIST to the Office of Management and Budget and to Congress as required by the National Technology Transfer and Advancement Act of 1995.

● Training

NIST provides a growing number of formal training programs. In FY 2007, 1,873 attendees attended 62 NIST training classes, an increase of 82% of the 1,029 attendees participating in 60 training classes in FY 2006. Among the training sessions offered in FY 2007 were the pilot Summer Institute for Middle School Science Teachers (SIMSST) and the Standards in Trade Programs (SIT). The SIMSST was designed to halt the loss of interest of middle school students in science and math by focusing on teacher training. Twelve teachers participated, under the auspices of a Memorandum of Understanding with Montgomery County Public Schools. Eleven teachers are currently assigned to teach middle school science, and one teacher who has been teaching middle school science is now a science specialist at an elementary school.

Among the FY 2007 Standards in Trade (SIT) Programs was a program on Oil and Gas for South America that facilitated information exchange on the regulatory framework pertaining to the oil and gas sector in the U.S. and Argentina, Brazil, Bolivia, Chile, Colombia, Ecuador, Peru, and Venezuela. The First SIT Program held outside the U.S. -- the U.S.-China Workshop for Intelligent Transportation Systems -- was held in Beijing, China. It provided a forum for the discussion of standards and codes, their development, conformity assessment and regulation in the U.S. and China as they relate to intelligent transportation systems and their components. The Standard in Trade Workshops support the measurement, and standards infrastructure underpinning U.S. exports.

● Outreach to trade and technical media

NIST devotes considerable attention to publicizing its planned, ongoing, and recently completed work in the trade and technical press, which is followed by organizations most likely to have an interest in utilizing the results of NIST's work and the agency's research and services. In addition to its news releases, web site, and contacts with the media, NIST publishes Tech Beat, a bi-weekly lay language newsletter of recent research results.

II.2. Performance in FY 2007: Activities and Achievements

The data below quantify the many ways through which NIST transfers knowledge and technology to the private sector.

In response to the reporting requirements of the Technology Transfer Commercialization Act of 2000 and other relevant legislation, data are provided for collaborative relationships for research

and development (CRADAs and other kinds of relationships), invention disclosures and patenting, and licensing. In addition, in keeping with the previous discussion, data are also provided for some of the other technology transfer mechanisms utilized by the NIST laboratories: such as Standard Reference Materials available, technical publications produced, calibration tests, and guest researcher collaborations. A number of examples of downstream outcomes from NIST technology transfer activities are also provided.

■ Collaborative Relationships for Research & Development

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● CRADAs, total active in the FY (1)	1,653	1,641	1,618	2,488	2,488
- New, executed in the FY	1,589	1,605	1,579	1,646	1,585
▪ Traditional CRADAs, (2) total active in the FY	*76	*51	*65	135	140
- New, executed in the FY	12	15	26	74	20
▪ Non-traditional CRADAs, (3) total active in the FY	1,577	1,590	1,553	2,353***	2,348
- New, executed in the FY	**1,577	**1,590	**1,553	1,572***	1,565
● Other types of collaborative R&D relationships					
▪ Facility use agreements, total in effect, end of FY (4)	511	590	588	639	998
- New, executed in the FY	308	239	280	283	307
▪ Guest scientists and engineers during the FY (5)	1,300	1,700	2,115	2,114	2,672

CRADA = Cooperative Research and Development Agreement.

-- = Data not requested from agency in reports of earlier years.

a = Figures are approximate.

* Includes CRADAs associated with all NIST programs, including Manufacturing Extension Partnership (MEP), and Technology Services (TS).

** "non-traditional" CRADAs protect the results (under CRADA authority) of calibrated items from disclosure for a period of five years after development. Such "non-traditional" CRADAs are issued (and terminate) on an annual basis.

*** includes laboratory accreditation under the CRADA authority.

(1) "Active" = legally in force at any time during the FY. "Total active" is comprehensive of all agreements executed under CRADA authority (15 USC 3710a).

(2) CRADAs involving collaborative research and development by a federal laboratory and non-federal partners.

(3) CRADAs used for special purposes -- such as, material transfer or technical assistance that may result in protected information.

(4) NIST authorizes individuals to use designated facilities. The numbers reported here represent the Facility Use Agreements in effect for the NIST Center for Neutron Research.

(5) "Guest scientists and engineers" includes foreign and domestic guest researchers, and researchers working at NIST under Intergovernmental Personnel Act (IPA) Agreements, CRADAs, and Facility Use agreements.

■ Invention Disclosure and Patenting

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● New inventions disclosed in the FY (1)	16	23	19	10	29
● Patent applications filed in the FY (2)	8	12	11	4	6
● Patents issued in the FY	9	11	9	6	3
● Active patents, end of the FY	190	161	154	132	129
● Patents purposely dropped (triaged) during the FY	15	26	14	24	8

(1) Inventions arising at the federal lab.

(2) Tally includes U.S. patent applications, foreign patent applications filed on cases for which no U.S. application was filed, divisional applications, and continuation-in-part applications. Excludes provisional, continuation, duplicate foreign, and PCT applications.

■ Licensing

Profile of Active Licenses

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● **All licenses**, number total active in the FY (1)	39	22	26	24	25
New, executed in the FY	3	2	5	3	5
▪ **Invention licenses**, total active in the FY	39	22	26	24	30
New, executed in the FY	3	2	5	3	5
- Patent licenses, (2) total active in FY	39	22	26	24	30
New, executed in the FY	3	2	5	3	5
- Material transfer licenses (inventions), total active	0	0	0	0	0
New, executed in the FY	0	0	0	0	0
- Other invention licenses, total active in the FY	0	0	0	0	0
New, executed in the FY	0	0	0	0	0
▪ **Other IP licenses**, total active in the FY	0	0	0	0	0
New, executed in the FY	0	0	0	0	0
- Copyright licenses (fee bearing)	0	0	0	0	0
New, executed in the FY	0	0	0	0	0
- Material transfer licenses (non-inventions), total active	0	0	0	0	0
New, executed in the FY	0	0	0	0	0
- Other, total active in the FY	0	0	0	0	0
New, executed in the FY	0	0	0	0	0

Multiple inventions in a single license are counted as one license. Licenses that include both patents and copyrights (hybrid licenses) are reported as patent licenses -- and not included in the count of copyright licenses.

(1) "Active" = legally in force at any time during the FY.

(2) Patent license tally includes patent applications which are licensed.

Licensing Management

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● **Elapsed execution time**, (1) licenses granted in the FY					
▪ **Invention licenses**					
▫ Average, months	3.4	*	1.0	6.0	2.0
▫ Minimum	1.0		1.0	1.0	1.0
▫ Maximum	10.0		1.0	13.0	3.0
- Patent licenses (2)					
▫ Average, months	3.4	*	1.0	6.0	2.0
▫ Minimum	1.0		1.0	1.0	1.0
▫ Maximum	10.0		1.0	13.0	3.0
● **Licenses terminated for cause**, number in the FY					
▪ **Invention licenses**	1	0	1	0	0
- Patent licenses (2)	1	0	1	0	0

Data included in this table (intentionally) addresses only invention licenses, with patent licenses distinguished as a subclass.

* NIST processed no commercialization licenses in FY 2004.

(1) Date of license application to the date of license execution. (Date of license application is the date the lab formally acknowledges the written request for a license from a prospective licensee and agrees to enter into negotiations.)

(2) Patent license tally includes patent applications which are licensed.

Characteristics of Licenses Bearing Income

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● **All income bearing licenses**, total number	29	15	17	18	21
▫ Exclusive	19	10	11	16	16
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	10	5	6	2	5
▪ **Invention licenses**, income bearing	29	15	17	18	21
▫ Exclusive	19	10	11	16	16
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	10	5	6	2	5
- Patent licenses, (1) income bearing	29	15	17	18	21
▫ Exclusive	19	10	11	16	16
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	10	5	6	2	5
▪ **Other IP licenses**, income bearing	0	0	0	0	0
▫ Exclusive					
▫ Partially exclusive					

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
▫ Non-exclusive					
- Copyright licenses (fee bearing)	0	0	0	0	0
▫ Exclusive ▫ Partially exclusive ▫ Non-exclusive					
● **All royalty bearing licenses**, [2] total number	29	15	17	18	21
▪ **Invention licenses**, royalty bearing	29	15	17	18	21
- Patent licenses, [1] royalty bearing	29	15	17	18	21
▪ **Other IP licenses**, royalty bearing	0	0	0	0	0
- Copyright licenses (fee bearing)	0	0	0	0	0

In general, license income can result from various sources: license issue fees, earned royalties, minimum annual royalties, paid-up license fees, and reimbursement for full-cost recovery of goods and services provided by the lab to the licensee including patent costs.

(1) Patent license tally includes patent applications which are licensed.

(2) Note that royalties are one component of total license income.

Income from Licenses

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● **Total income**, all licenses active in FY [1]	$122,850	$144,828	$123,348	$156,793	$195,347
▪ **Invention licenses**	$122,850	$144,828	$123,348	$156,793	$195,347
- Patent licenses [2]	$122,850	$144,828	$123,348	$156,793	$195,347
▪ **Other IP licenses**, total active in the FY	0	0	0	0	0
- Copyright licenses	0	0	0	0	0
● **Total Earned Royalty Income** (ERI) [3]	$122,850	$144,828	$123,348	$156,793	$195,347
▫ Median ERI	n/a	n/a	*$2,500	$5,000	$15,000
▫ Minimum ERI	$960	$640	$640	$640	$1,280
▫ Maximum ERI	$35,000	$54,072	$45,000	$85,403	$169,067
▫ ERI from top 1% of licenses	$35,000	dw	dw	dw	dw
▫ ERI from top 5% of licenses	$35,000	dw	dw	dw	dw
▫ ERI from top 20% of licenses	$45,000	dw	dw	dw	dw
▪ **Invention licenses**	$122,850	$144,828	$123,348	$156,793	$195,347
▫ Median ERI	n/a	n/a	*$2,500	$5000	$15,000
▫ Minimum ERI	$960	$640	$640	$640	$1,280
▫ Maximum ERI	$35,000	$54,072	$45,000	$85,403	$169,067
▫ ERI from top 1% of licenses	$35,000	dw	dw	dw	dw
▫ ERI from top 5% of licenses	$35,000	dw	dw	dw	dw
▫ ERI from top 20% of licenses	$45,000	dw	dw	dw	dw

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
- Patent licenses [2]	$122,850	$144,828	$123,348	$156,793	$195,347
▫ Median ERI	n/a	n/a	*$2,500	$5000	$15,000
▫ Minimum ERI	$960	$640	$640	$640	$1,280
▫ Maximum ERI	$35,000	$54,072	$45,000	$85,403	$169,067
▫ ERI from top 1% of licenses	$35,000	dw	dw	dw	dw
▫ ERI from top 5% of licenses	$35,000	dw	dw	dw	dw
▫ ERI from top 20% of licenses	$45,000	dw	dw	dw	dw
▪ **Other IP licenses**, total active in the FY	0	0	0	0	0
▫ Median ERI					
▫ Minimum ERI					
▫ Maximum ERI					
▫ ERI from top 1% of licenses					
▫ ERI from top 5% of licenses					
▫ ERI from top 20% of licenses					
- Copyright licenses	0	0	0	0	0
▫ Median ERI					
▫ Minimum ERI					
▫ Maximum ERI					
▫ ERI from top 1% of licenses					
▫ ERI from top 5% of licenses					
▫ ERI from top 20% of licenses					

n/a = Data not available from agency at time of this report.

dw = Data withheld to protect proprietary information.

* The distribution of NIST's annual license income is bimodal at the extremes. The median figure cited here is rather unrepresentative.

(1) Total income includes license issue fees, earned royalties, minimum annual royalties, paid-up license fees, and reimbursement for full-cost recovery of goods and services provided by the lab to the licensee including patent costs.

(2) Patent license tally includes patent applications which are licensed.

(3) "Earned royalty" = royalty based upon use of a licensed invention (usually, a percentage of sales or of units sold). Not a license issue fee or a minimum royalty.

Disposition of License Income

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● **Income distributed** [1]					
▪ **Invention licenses**, total distributed	$122,850	$144,828	$123,348	$156,793	$195,347
- To inventor(s)	$51,773 (42%)	$54,134 (37%)	$48,148 (39%)	$47,536 (30%)	$65,100 (33%)
- To other [3]	$71,076 (58%)	$90,694 (63%)	$75,199 (61%)	$109,257 (70%)	$130,247 (67%)
- Patent licenses,[2] total distributed	$122,850	$144,828	$123,348	$156,793	$195,347
- To inventor(s)	$51,773 (42%)	$54,134 (37%)	$48,148 (39%)	$47,536 (30%)	$65,100 (33%)
- To other [3]	$71,076 (58%)	$90,694 (63%)	*$75,199 (61%)	$109,257 (70%)	$130,247 (67%)

Invention licenses are the chief policy interest regarding disposition of income; content of table reflects this focus.

(1) Income includes royalties and other payments received during the FY.
(2) Patent license tally includes patent applications which are licensed.
(3) NIST only in FY 2001-04. In FY 2005, $1500 to NIH and rest to NIST

■ Other Performance Measures Deemed Important by the Agency

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
Standard Reference Materials (SRMs) available [1]	1,214	1,211	1,246	1,302	1,285
Standard Reference Materials (SRMs) sold [2]	29,527	30,490	32,163	31,195	32,614
Standard Reference Data (SRD) titles available [3]	106	95	110	113	109
Number of calibration tests performed [4]	13,987	12,503	12,849	13,127	27,489*
Technical publications in peer-reviewed journals [5]	NA	1,070	1,148	1,163	1,272

* This number of tests is significantly different from the usual annual average of 13,000 principally due to a surge in calibration testing for the military and its contractors in the fourth quarter of FY 2007.

See Section above for additional information about the measures listed here. See also the Department of Commerce's annual reports under the Government Performance and Results Act (GPRA) and the annual Performance Plan for detailed information about each of these measures, analysis of trends, and future-year performance projections.

(1) Direct and verifiable count of SRMs available to customers at the close of the fiscal year. The number of SRMs available for sale illustrates the breadth of measurements supported by NIST. Over time, NIST expects slight growth in the number of SRMs available.
(2) Direct and verifiable count of NIST SRM units sold during the fiscal year. In recent years, NIST had been expecting a continuing slight decline in the number of SRM units sold, as NIST made greater use of highly leveraged SRM services over time, including accreditation of Nationally Traceable Reference Material producers. However, in FY 2005, the number of SRMs sold increased. Some possible contributing factors include the implementation of new EPA regulations, environmental activities, increased in construction projects, and the availability of previously out-of-stock SRMs.
(3) Direct and verifiable count of SRD products developed and disseminated by NIST. NIST expects continued modest growth in the total number of SRD titles available. Of those titles currently available, about 50% are available for sale, and 50% are free online systems. Over time, a larger percentage of SRDs will be distributed via the Internet. New growth in online systems is anticipated for FY 2008 with the release of fee-based titles for the Internet.

(4) Direct and verifiable count of calibration tests performed by the NIST laboratories.
(5) Direct and verifiable count of the annual number of NIST's technical publications appearing in influential scientific peer-reviewed journals.

Outcomes from NIST Technology Transfer Activities

■ Cooperative Research and Development Agreement (CRADA)

● Making Robotic Movement of Goods More 'Pallet-able'

Under a cooperative research and development agreement (CRADA) with Transbotics, a Charlotte, N.C., automatic guided vehicle (AGV) manufacturer, NIST has developed advanced sensor processing and modeling algorithms to help robot forklifts verify the location and orientation of pallets laden with goods.

The experimental system utilizes two onboard, single scan-line LADAR devices to negotiate obstacles and home in on warehouse pallets. (LADAR—Laser Detection and Ranging—is an optical technology which measures properties of scattered laser light to find range and other information about a distant target.) One LADAR device, located at the base of the AGV, is used as a safety sensor to detect obstacles such as humans in the forklift's path. It also can be used to scan inside a truck's cargo area to detect the presence of a pallet or define distances from the forklift to the truck's inside walls.

The other sensor, called the Panner, is a panning laser ranger mounted on a rotating motor at the top front of the AGV. The Panner acquires many scan lines of range data that allows the scene in front of the device to be reconstructed in various visual formats such as a pseudo-colored coded image (where colors indicate relative proximity to an object) or a 3-dimensional data point "cloud." A computer model is then derived from the data with the output sent immediately to the AGV's control center. This allows the robot forklift to maneuver, load and unload pallets, verify the remaining space within the truck being loaded, and track the number of pallets still needing handling.

Transbotics is planning to implement the NIST pallet verification software on one of its AGVs in 2007 for use in real manufacturing situations.

■ Licensing

● NIST Licenses Systems To Help The Blind See

A recently completed licensing agreement for two novel NIST technologies may help bring affordable graphic reading systems for the blind and visually impaired to market. The two systems bring electronic images to life in the same way that Braille makes words readable.

ELIA Life Technology Inc. of New York, N.Y., licensed for commercialization both the tactile graphic display device and fingertip graphic reader developed by NIST researchers. The former, first introduced as a prototype in 2002, allows a person to feel a succession of images on a reusable surface by raising some 3,600 small pins (actuator points) into a pattern that can be locked in place, read by touch and then reset to display the next graphic in line. Each image—from scanned illustrations, Web pages, electronic books or other sources—is sent electronically to the reader where special software determines how to create a matching tactile display.

An array of about 100 small, very closely spaced (1/10 of a millimeter apart) actuator points set against a user's fingertip is the key to the more recently created "tactile graphic display for

localized sensory stimulation." To "view" a computer graphic with this technology, a blind or visually impaired person moves a device-tipped finger across a surface like a computer mouse to scan an image in computer memory. The computer sends a signal to the display device and moves the actuators against the skin to "translate" the pattern, replicating the sensation of the finger moving over the pattern being displayed. With further development, the technology could possibly be used to make fingertip tactile graphics practical for virtual reality systems or give a detailed sense of touch to robotic control (teleoperation) and space suit gloves.

■ Standards Development/Implementation

● New Scoring System Protects Credit Card Transactions

Credit card transactions may be a little more secure thanks to standards adopted by the payment card industry. The latest incarnation of these standards includes the Common Vulnerability Scoring System (CVSS) Version 2 that was coauthored this year by researchers at NIST and Carnegie Mellon University in collaboration with 23 other organizations.

When people make an electronic transaction—either swiping a card at a checkout counter or through a commercial Web site—they enter personal payment information into a computer. That information is sent to a payment-card "server," a computer system often run by the bank or merchant that sponsors the particular card. The server processes the payment data, communicates the transaction to the vendor, and authorizes the purchase.

According to NIST's Peter Mell, lead author of CVSS Version 2, a payment-card server is like a house with many doors. Each door represents a potential vulnerability in the operating system or programs. Attackers check to see if any of the "doors" are open, and if they find one, they can often take control of all or part of the server and potentially steal financial information, such as credit card numbers.

For every potential vulnerability, CVSS Version 2 calculates its risks on a scale from zero to 10, assessing how the vulnerability could compromise confidentiality (exposing private information such as credit card numbers), availability (could it be used to shut down the credit card system?) and integrity (can it change credit card data?). The CVSS scores used by the credit card industry are those for the 28,000 vulnerabilities provided by the NIST National Vulnerability Database (NVD), sponsored by the Department of Homeland Security.

To assess the security of their servers, payment card vendors use software that scans their systems for vulnerabilities. To promote uniform standards in this important software, the PCI (Payment Card Industry) Security Standards Council, an industry organization, maintains the Approved Scanning Vendor (ASV) compliance program, which currently covers 135 vendors, including assessors who do onsite audits of PCI information security. By June 2008, all ASV scanners must use the current version of CVSS in order to identify security vulnerabilities and score them. Requiring ASV software to use CVSS, according to Bob Russo, General Manager of the PCI Security Standards Council, promotes consistency between vendors and ultimately provides good information for protecting electronic transactions. The council also plans to use NIST's upcoming enhancements to CVSS, which will go beyond scoring vulnerabilities to identify secure configurations on operation systems and applications.

● NIST Team Transfers Optical Trap Technology

In an informal collaboration, NIST researchers transferred the design, assembly, test and operational knowledge of a highly accurate optical power detector to Spectrum Detector, Inc. Innovations in diverse areas such as optical communications, laser machining, and medicine rely on knowing precisely the characteristics of optical power sources being utilized. For example, every time a phone call is made, the information travels along a fiber optic cable that has a laser on one end and a detector on the other. Accurate, more sensitive detectors allow more calls to be put through on the same line and decrease costs.

NIST scientists developed transfer standard detectors based on a unique optical trap design concept that improved the dissemination of optical power internal to NIST and among the metrology institutes of other countries. These optical trap detectors represent the state-of-the-art in calibration transfer standards for laser power measurements and form the basis of this technology transfer. The novel trap design allows the measurement of a variety of optical beam geometries, thus supporting diverse optical sources such as laser beams, optical fibers, light emitting diodes (LEDs), and lamps, and provides improved accuracy while increasing the tolerance to optical beam variations. This invention, NIST's Optical Trap Detector for Calibration of Laser Power, has successfully decreased metrological uncertainty for both commercial manufacturers and users of energy meters and National Metrology Institutes worldwide and through this technology transfer is improving manufacturing operations and product quality across multiple industries.

Spectrum Detector Inc. is a small business that has successfully commercialized six products based on this knowledge. The commercial availability of a metrology-grade trap-detector is allowing companies that manufacture and use laser power and energy meters to obtain stable, high-accuracy transfer standards, at a reasonable price.

● New Standard Shortens Design Efforts for Metal Forming Industries

NIST staff, working with researchers from Ford, U.S. Steel, and FormSys, standardized a simple springback test method originally developed as part of a NIST Advanced Technology Program project with the U.S. Council for Automotive Research (USCAR).

To make a car part, huge presses form sheet metal in a die that is similar, but not identical, to the finished part. The formed part has residual stresses and springs back, hopefully to the desired shape, when removed from the die. The designer of the die compensates for this springback in an iterative, experience-based process that can only begin once a full-size die is created. The rework necessary to complete the die design greatly increases the completion time and cost of the part. Until recently, auto manufacturers had no standard method to evaluate the propensity for springback of promising materials such as new aluminum alloys or high-strength steels.

The standard uses a simple, flat-bottomed cup geometry, about twice the diameter of a soda can. After forming, a ring of material from the sidewall of the cup is removed and split. The residual stress left in the ring from the forming operation causes the ring to spring open into a "C" shape. The size of the opening of the mouth of the "C" is a result of the residual stress in the wall, and thus is a measure of the propensity for springback in parts with more complex shapes.

Staff from the NIST Center for Neutron Research used neutron diffraction techniques to map out residual stresses in the cup to gain an essential understanding of the test. Metallurgy staff evaluated the robustness of the technique on several different alloys, which was essential for

transforming the test method into a standard. The new standard allows auto manufacturers to refine their computational models and determine in advance how new materials will behave, thus shortening completion time and reducing costs associated with die redesign.

● NIST WTC Recommendations Spur New Model Building Codes

Safer buildings—especially tall structures—that are more resistant to fire and more easily evacuated in emergencies are the goal of the first comprehensive set of building code changes recently approved by the International Code Council (ICC), based on recommendations from NIST. The recommendations were the result of the findings of NIST's three-year investigation of the collapses of New York City's World Trade Center (WTC) towers on Sept. 11, 2001.

Changes reflecting eight of NIST's recommendations were incorporated into the 2007 supplement to the ICC's International Building Code (IBC), a model code used as the basis for building regulations promulgated and enforced by U.S., state and local jurisdictions. Those jurisdictions have the option of incorporating some or all of the code's provisions but generally adopt most provisions.

The model code changes address such areas as the fire resistance of structural components, the use of sprayed fire-resistive materials (commonly known as "fireproofing"), elevators for use by first responders, the number of stairwells, and exit path markings.

In August 2007, a total of forty-seven proposals for further changes were submitted to the ICC for consideration during the 2007/2008 code cycle. Proposals adopted during the 2007/2008 code cycle will appear in the next edition of IBC in 2009.

"We fully endorse these code changes and are gratified that NIST's WTC recommendations have stimulated fundamental and substantial changes in U.S. building codes and standards that represent a significant improvement in public safety over current practice," said Shyam Sunder, lead WTC investigator for NIST. "NIST is committed to continuing our work to support industry and the nation's building and fire safety officials so that the remaining recommendations also are fully considered."

● NIST/Industry Quality Measurement Data Standard

NIST researchers, together with colleagues from the Automotive Industry Action Group (AIAG), key manufacturing companies, and quality software vendors, have completed work on a new data specification that will allow compliant products to store and exchange measurement data from process-monitoring instruments in a completely open and non-proprietary format. Widespread use of the new quality measurement data (QMD) specification, which defines the information exchanged between factory floor measurement instruments and Statistical Process Control (SPC) software, should provide substantial savings to quality systems users and their suppliers throughout the manufacturing sector.

Manufacturers worldwide use a wide variety of measurement instruments and systems to monitor processes and measure critical values of parts and assemblies at their factories as part of quality control. These measurement devices need to communicate with software components—from a variety of vendors—that collect and process the measurements. However, a measuring device typically cannot communicate with statistical process-control software unless both the device and the software component speak the software vendor's proprietary language … and the 1,500 to 2,000 existing quality data "languages" makes transfer of information difficult. This widely

recognized interoperability problem causes large and unnecessary costs to users, suppliers and vendors.

The QMD development effort represents the first time that a group of competing providers of widely used quality software have joined forces to define an open and completely non-proprietary quality data solution, based on the general XML data format, for all types of quality data—not just dimensional metrology data—in a format that captures all the necessary characterization of the data. QMD is also an entirely generic streaming data format that is measurement-system and database-schema independent—and thus can convey quality data measurements from any source to any target.

NIST supports the now two-year-old QMD development effort in a variety of ways. NIST created a QMD test suite, which is being used to verify whether a vendor's implementation of the QMD specification actually conforms to the specification. Such testing is critical to ensure interoperability.

■Informal Collaboration/Publication

● Bug-Zapper: A Dose of Radiation May Help Knock Out Malaria

Researchers at NIST are helping an effort to eradicate malaria, the mosquito-borne disease that kills more than one million people every year. NIST physicists used their expertise in radiation science in an informal collaboration to help a young company create weakened, harmless versions of the malaria-causing parasite. These parasites, in turn, are being used to create a new type of vaccine that shows promise of being more effective than current malaria vaccines.

The new vaccine is a departure from previous approaches, which have usually depended on proteins derived from only part of the parasite Plasmodium falciparum, the most dangerous species of parasite that causes malaria. Using vaccines based on whole living parasites had been on scientists' minds for several decades after they discovered that volunteers built up high levels of protection to malaria after being exposed to mosquitoes containing live, radiation-weakened parasites. But manufacturing technology only recently has been developed to the point where it is possible to efficiently extract weakened parasites from their mosquito carriers to make a vaccine.

With their knowledge of measuring radiation doses for industrial processes such as medical equipment sterilization, NIST researchers have been lending their expertise for several years to Maryland-based biotech firm Sanaria, Inc., which is creating the new vaccine. In the manufacturing process, live mosquitoes containing the parasite are exposed to gamma rays. To ensure that the parasites are sufficiently weakened for the vaccine, yet remain alive, they must be exposed to a radiation dose of at least 150 gray, but not much more. Coincidentally, this is also the dose used to delay sprouting in potatoes and onions.

One critical design issue is ensuring a relatively uniform radiation dose regardless of where the mosquito is in the chamber. Using radiation-sensitive test materials inside the chamber as well as sophisticated measuring equipment, NIST researchers mapped out the radiation dose at different parts of the chamber. They initially found there was a variation in dose within the chamber, but by suggesting that the manufacturer change the position of the chamber relative to the radiation source they were able to reduce this variation in dose significantly. This not only increases the speed of the process, but more importantly improves the quality of the process. To be safe for human trials all mosquitoes in the chamber must get their minimum dose of 150 gray.

The vaccine is currently being manufactured for the anticipated human clinical trials. NIST researchers will continue to be active in the manufacturing process by doing regularly scheduled quality-assurance tests that ensure the desired dose is being delivered to the mosquitoes.

● Fans Clear High-Rise Stairwells of Smoke

As described in a recent NIST publication, high pressure fans that direct air flow up the stairway of a burning high-rise building can increase the effectiveness of firefighters and the survivability of occupants by ridding the stairwell of smoke and toxic gases.

The NIST analysis of 160 experiments conducted last year with small and large fans in the stairwell of a vacant 30-story office building in Toledo, Ohio, showed that the positive pressure ventilation (PPV) techniques used in small homes also worked in tall structures. The NIST engineers found that portable PPV fans, if used correctly, can both limit the amount of smoke and heat entering the stairway, and push smoke and deadly gases out of the structure. Data were collected with smoke and pressure measurement devices.

Pressurization smoke control systems, which usually consist of mounted wall fans, have been incorporated into high-rise buildings since the 1970s. The NIST Toledo experiments, however, represented the first scientific evaluation of positive pressure ventilation technology using portable fans for buildings without built-in systems.

The NIST researchers developed several guidelines for the most effective use and positioning of portable PPV fans. The researchers also noted that the noise level near the working fans could go as high as 110 decibels—comparable to the level of a chainsaw—making communication difficult, and recommended that the fire command post be sited well away from the fans.

The NIST report urges further experiments to update current fan airflow performance standards for PPV needs. Manufacturers could certify airflow rates for specific fans. To aid fan selection, firefighter organizations also could use formulas that incorporate data for certified airflows with information related to the height or the volume of a building.

● Reducing Trade Barriers: Mangoes for Motorcycles

In collaboration with the United States Department of Agriculture (USDA), NIST participated in the successful introduction of NIST-Traceable Certification of a gamma radiation treatment process. Since 1988, India had been trying to export mangoes into the United States, but their import had been banned over concerns that insects carried with the fruit (e.g., fruit flies and a weevil commonly found in the fruit's pit) could seriously damage U.S. agriculture. President Bush agreed to lift the ban on his visit to India last year, reportedly in return for India allowing Harley-Davidson motorcycle imports. However, means had to be devised to solve the insect problem.

James Puhl of NIST traveled to India with a team of USDA experts to certify a gamma radiation treatment process. The facilities in India had to demonstrate that their capabilities, treatment plan, and quality control system could ensure that the fruit would receive an absorbed dose of radiation that was high enough to kill or sterilize the pests while keeping the fruit palatable. Prior to traveling to India, Puhl and the USDA team leader met at NIST with other experts to review Indian technical documents and to devise a plan that would ensure rapid certification of the process with measurements traceable to NIST standards. The first Indian mango shipment arrived four months earlier than the target date set in the March 2006 agreement between USDA and the Indian Ministry of Agriculture. This shipment was marked by a ceremony on May 1,

2007, at the U.S. Chamber of Commerce, hosted by the U.S.-India Business Council. In attendance were the U.S. Ambassador to India, the Indian Ambassador to the United States, the U.S. Secretary of Agriculture, and many officials from the DoC and the USDA.

India is the world's largest producer of mangoes, and the Alphonso variety being treated for export is considered the king of mangoes for its outstanding flavor and texture. The Washington Post, in a feature article about "India's Favorite Fruit" in its Food Section on May 9, 2007, expressed it this way: "These were mangoes worth waiting for." This event also marked a milestone for use of irradiation technology in safeguarding U.S. agriculture. These mangoes are the first irradiated fruits imported into the United States.

● Building Retrofits Reduce Chemical/Biological Hazards Risks

A new report from NIST and the U.S. Environmental Protection Agency (EPA) offers building owners and managers information on retrofit options to improve the safety of buildings against airborne chemical and biological hazards. The new guide can be used to determine whether or not—and how—to harden existing buildings against accidental chemical releases or possible terrorist threats.

NIST researchers evaluated 14 alternative retrofit techniques based on data from simulated airflow and contaminant transport computer modeling as well as a case study in which retrofits were designed for a high-rise and single story building. In conjunction with the report, NIST also developed a life-cycle cost analysis tool for chemical and biological protection of buildings that helps building owners and managers to compare life-cycle costs of installation, operation and maintenance to determine the most cost-effective combination of retrofit options for their structure.

Retrofit options considered include enhanced particle filtration, ultraviolet germicidal irradiation, work area air capture and filtration equipment such as mail handling tables, ventilation system recommissioning, building envelope air-tightening, building pressurization, relocation of outdoor air intakes, shelter-in-place, isolation of vulnerable spaces such as lobbies, system shutdown and purge cycles, and automated heating, ventilating and air-conditioning (HVAC) operational changes in response to contaminant sensing.

Potential advantages, disadvantages and knowledge gaps are discussed for each technology. For example, the researchers note that filtration and air cleaning options have the advantage of being always in operation. But, as the report notes, their disadvantage is a current lack of standards for testing and rating gaseous air cleaning systems and other air cleaning approaches. The study also notes that the potential for increased energy efficiency and improved indoor air quality results from various retrofit options, which could play a role in life-cycle cost comparisons of different strategies.

■ Standard Reference Materials

● Ginkgo Standard Reference Materials: Tools for Product Analysis/Quality

NIST has issued a suite of Standard Reference Materials (SRMs) for ginkgo biloba, one of the most popular dietary supplements in the marketplace, with annual worldwide sales estimated at $1 billion.

The NIST reference materials are designed to help researchers validate the accuracy of analytical methods for flavonoids and terpene lactones (plant constituents that may be associated with the

perceived effectiveness of ginkgo) as well as toxic elements in ginkgo. In addition to supporting measurements associated with clinical trials or verifying product label claims, the reference materials also can be used by dietary supplement manufacturers to improve product consistency.

The fruits and seeds of the female ginkgo are used for a variety of purposes in traditional Chinese medicine. In the West, dietary supplements are more commonly formulated from ginkgo leaves and standardized leaf extracts. They are used in the treatment of asthma, bronchitis, fatigue and tinnitus (ringing in the ears); for memory improvement and for the prevention and treatment of Alzheimer's disease, although these uses have not been backed by rigorous clinical trials. Ginkgo biloba contains a family of chemical constituents known as ginkgolides, which have been associated with reduced platelet aggregation. The National Institute of Health's (NIH) National Center for Complementary and Alternative Medicine (NCCAM) notes promising results in a number of areas, but states that larger, well-designed research studies are needed.

The new ginkgo reference materials include: SRM 3246 *Ginkgo biloba* (leaves); SRM 3247 *Ginkgo biloba* Extract; and SRM 3248 Ginkgo-Containing Tablets. In addition, the three ginkgo SRMs are available packaged together as SRM 3249. The reference materials come with certified values for five terpene lactones, three flavonoid aglycones and four potentially toxic trace elements (arsenic, cadmium, lead and mercury).

The goal of NIST's ongoing effort with dietary supplements such as ginkgo biloba is to provide tools to the dietary supplement industry and measurement communities that will lead to improved quality of dietary supplements and the studies of their efficacy, as well as to ultimately reduce public health risks that could potentially be associated with the use of these products.

● SRMs Track Fire Retardants in Humans and Environment

To help investigators get a handle on the source and degree of PBDE contamination, NIST measured concentrations of selected PBDEs and other brominated flame retardants including hexabormocyclododecane (HBCD) in seven of the agency's existing Standard Reference Materials (SRMs) that are considered benchmarks for measurements of environmental pollutants.

Concentration values for PBDEs are now available for NIST's reference materials for house dust (SRM 2585), cod liver oil (SRM 1588b) and human blood serum (SRM 1589a). Newly certified values for PBDE concentrations in four other SRMs for whale blubber, mussel tissue and two types of fish tissue are expected to be available soon.

Ideally, the flame retardant chemicals routinely added to consumer products from carpets to cell phones would just do their job and nothing more. Health officials, however, are concerned that one class of these chemicals called polybrominated diphenylethers (PBDEs), may be doing more than reducing fire-related injuries and property damage.

After several decades of use, PBDEs are widely distributed in the environment as contaminants, and trace levels of these chemicals can be measured in animal tissues and in the food chain (they can be found, for example, in bird eggs and human breast milk). To help scientists evaluate the risks of PBDEs by improving measurements of these pollutants in the environment, NIST has re-evaluated several of its environmental reference materials to report PBDE concentrations in them.

Different commercial PBDE flame retardant formulations have been used, including pentaBDE in furniture foam; decaBDE in plastics for television cabinets, consumer electronics, draperies

and upholstery; and octaDBE in plastics for personal computers and small appliances. Although human data on health effects are limited, the U.S., Environmental Protection Agency (EPA) cites animal tests as evidence that PBDEs are neurodevelopmental toxins, disruptors of thyroid functions, and liver toxins. The doses used in animal studies were slightly higher than PBDE levels found in some people in the United States.

U.S. production of pentaBDE and octaBDE formulations ended in 2004. DecaBDE (formulations which do not seem to be easily accumulated in humans, but can degrade to octaBDEs and pentaBDEs) are not banned. Pathways by which PBDEs enter the environment and humans are not yet known. Human exposure might come from food, manufacturing, or even from use of consumer products such as furniture.

In collaboration with the Centers for Disease Control and Prevention (CDC), NIST also is developing four new SRMs based on human blood and milk. Two of these SRMs will have certified values for current PBDE concentrations to record the level of current human exposure. PBDEs will be added at higher levels for the other two materials to facilitate comparability of measurements among laboratories.

● Improved NIST SRM Aids Lead Poisoning Detection

Lead in goat blood might not be on the top of your shopping list, but for U.S. medical personnel who each year perform more than 2 million human blood measurements, Standard Reference Material (SRM) 955c from NIST can't be beat.

SRM 955c is an improved version of SRM 955b, a material clinicians already relied on heavily to provide quality assurance for lead blood measurements. Significant changes in material composition, lead levels and expanded uncertainties of the certified lead concentrations make SRM 955c an even more effective tool for use in addressing lead poisoning, a condition particularly harmful to the developing nervous systems of fetuses and young children, causing learning disabilities and behavior problems and, at high levels, seizures, coma and death.

Children can be exposed to lead from lead-based paint in older buildings, or from contaminated soil near highways where vehicles once used leaded gasoline. Lead levels in children have dropped since lead was banned from both paint and fuel, but they remain significant. In 1990 the U.S. Department of Health and Human Services (DHHS) established as a national goal reducing lead blood levels to no greater than 25 micrograms per deciliter (the equivalent of 250 parts per billion) by 2000 and no greater than 10 micrograms per deciliter (100 parts per billion) by 2010. The department's Centers for Disease Control and Prevention (CDC) currently estimates that 300,000 American children, aged one to five years, have lead blood levels greater than the 2010 objective. Research reports also provide evidence of adverse effects at an even lower lead blood level than that of the 2010 target among children younger than 72 months.

SRM 955c is packaged as four vials of frozen blood at four progressively elevated lead concentration levels. Unlike previous issues of SRM 955 that were based on hog or cattle blood, SRM 955c is based on blood obtained from goats. The red blood cell system of an adult goat is much closer to that of a human, making it a better model for assessing proficiency for erythrocyte protoporphyrin, a biomarker of lead exposure. NIST's partner in developing 955c, the New York State Department of Health's Wadsworth Center Lead Poisoning Laboratory, dosed adult goats with lead acetate to produce blood pools containing lead physiologically bound to red blood cells. The new SRM provides a better match than its predecessor to the blood

samples clinicians analyze. The lead concentrations were determined by NIST using highly specialized methodology that resulted in high accuracy and low measurement uncertainty.

The changing goal line for blood lead concentration makes SRM 955c especially useful to laboratories. The lowest lead concentration level in the previous standard was 4 micrograms per deciliter or 40 parts per billion. In contrast, the lowest lead concentration level of SRM 955c is 0.4 microgram per deciliter or four parts per billion, the level of lead in an undosed animal. It is intended to represent the natural level of lead in an unexposed human population (although it is not yet known if any lead is naturally present in human blood). The lowest concentration in the SRM is 25 times lower than the DHHS 2010 goal, and will enable the development of next generation clinical methods that will be needed to accurately measure blood lead levels in children as progress is made toward eliminating lead exposure.

In addition to lead, levels two through four of SRM 955c contain added amounts of arsenic, cadmium, mercury, methylmercury and ethylmercury to facilitate future efforts to develop clinical methods to measure these toxins in human blood. At present, NIST provides information values only for the concentrations of cadmium and total mercury (including methylmercury and ethylmercury.) As values become available for arsenic, methylmercury and ethylmercury, the certificate of analysis will be updated to reflect the new information.

■Calibrations

● NIST Antenna Calibrations Extended to 60-110 GHz

NIST has developed a new "tabletop" sized facility to improve characterization of antennas operating in the 60 to 110 gigahertz (GHz) frequency range. This extended frequency capability serves needs for advanced civilian and military communication and radar systems.

Many electronic systems are moving to higher frequencies to attain higher channel capacity, better spatial resolution and other advantages. The new measurement facility will help accelerate development of technologies such as automobile collision-prevention radars, which operate at 94 GHz and require antennas small enough to be integrated into car bumpers. Improved NIST antenna calibration capability also helps to assure the accuracy of many systems. "NIST is the start of the measurement traceability chain," says Perry Wilson, leader of the NIST Radio Frequency Fields Group. "For instance, we calibrate the probes used by aerospace companies to calibrate instruments launched on satellites and other critical systems. Weather satellites are an example; improvements in antenna accuracy mean better data for weather models, resulting in better weather predictions."

The new facility continues NIST's history of innovation in antenna measurements, building on the "extrapolated gain" technique developed several decades ago. The original extrapolation range and techniques made it practical for researchers to accurately compute an antenna's far-field characteristics based on near-field measurements. By making the range compact, costs are significantly reduced. In addition, the extrapolation technique uses over-sampling and averaging techniques to minimize the effects of scattering and range imperfections.

The tabletop extrapolation range is used to measure the gain (increase in signal power) and polarization (orientation of the electric field) of high-performance antennas. To make measurements, one antenna is fixed on the table and a second is moved along a rail. A laser tracker is used for alignment and positioning. The laser tracker is capable of following a moving target with less than 20-micrometer uncertainty at 1,000 points per second. The range is arranged

on an optical table to provide the mechanical isolation and stability necessary to achieve low uncertainties at short wavelengths of radiation. Typical measurement uncertainty for some types of antennas in the 60 – 110 GHz range approaches that of NIST's existing calibration facilities for antennas operating at lower frequencies (less that 60 GHz).

III. NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Technology Transfer at the Agency's Federal Laboratories – Approach and Plans, FY 2007 Activities and Achievements

III.1. Agency Approach and Plans for Technology Transfer

The mission of the National Oceanic and Atmospheric Administration (NOAA) is to understand and predict changes in the Earth's environment and conserve and manage coastal and marine resources to meet the Nation's economic, social, and environmental needs. This mission will become ever more critical in the 21st century as national needs intensify concerning global warming, freshwater supply, ecosystem management, and homeland security.

NOAA is one of the nation's premier scientific agencies. NOAA science and technology impact the daily lives of the nation's citizens and have a significant effect on the national economy. For example, about one-third of the U.S. economy (approximately $3 trillion) is weather sensitive -- such as agriculture, energy, construction, health, travel, and transportation. Weather data and forecasts play a critical role in these major economic sectors of our economy-- and are transferred to industry and the public through the media, internet, and NOAA Weather Radio. Federal, State, and local governments and the public use weather warnings to save lives and prevent destruction of property. Television weathercasters and many weather related firms use weather data and forecasts in their daily operations. Industry uses NOAA data in home construction and design, crop selection, disease control, and fuel delivery and supply. Additionally, industry has applied weather data for deciding such things as automobile fuel delivery system design, the best time to market umbrellas, and even for when the conditions would be best for the mating of honeybees. Increasingly accurate and longer range weather forecasts depend on an ongoing program of research and development.

Research by NOAA's federal laboratories is aimed at assisting NOAA's operational components. NOAA's research is directed at such topic areas as weather forecasting, solar emission forecasting, estimating fish stocks, predicting water resources, warning of tsunamis, and charting ocean bottom topography. The results of such research are transferred to NOAA's operational components to improve prediction, management, and other mission activities.

NOAA's web page at www.noaa.gov details the voluminous amount of research and technology data made available to the public in the form of information products and services, such as weather and climate forecast data, El Nino prediction and monitoring, tides and currents, satellite imagery and direct readout, fishery statistics and information on protected species, air quality, state of the coasts, beach temperatures, and nautical charts, as well as extensive databases on climate, oceans, ice, atmosphere, geophysics, and the sun.

NOAA's primary technology transfer mechanism has historically been the open dissemination of scientific and technical information to individuals, industry, government, and universities. This means of transfer is consistent with the agency's mission and scientific tradition and has been found to be more efficient and economical than transfer through patenting and licensing. Even

so, NOAA continues, where advantageous, to transfer intellectual property through licenses and CRADAs -- including to industry to benefit the competitiveness of U.S. companies.

In FY 2007, NOAA conducted an extensive technology transfer program through applications of meteorological and oceanographic technologies and information, and through open dissemination to individuals, industry, government, and universities. In addition, NOAA provided daily weather forecasts and warnings through the media and NOAA Weather Radio. NOAA technology is transferred through presentations at scientific meetings, publication in peer-reviewed scientific journals, and through NOAA scientific and technical publications.

NOAA collaborates with other federal research agencies on science and technology development matters of joint interest. For example, NOAA and the Environmental Protection Agency (EPA) team to provide new experimental air quality forecast guidance that enables state and local agencies to issue more accurate and geographically specific air quality warnings to the public. The annual cost of poor air quality to the U.S. from air pollution-related illnesses has been estimated at $150 billion.

Furthermore, to ensure that the United States benefits from and fully exploits scientific research and technology developed abroad, NOAA collaborates and shares information with organizations in countries throughout the world. Through these international relationships, technology is transferred into NOAA for the eventual benefit of U.S. industry and public users. For instance, the understanding and forecasting of global phenomena that occur in the atmosphere, oceans, and on the sun require worldwide collaboration and information sharing. This is accomplished through formal agreements with individual countries and participation in international organizations, such as the World Meteorological Organization (WMO), the Intergovernmental Oceanographic Commission (IOC), and the International Astronomical Union (IAU). NOAA also participates in international scientific programs and shares technology and scientific data, such as in the Global Earth Observation System. This effort involves nearly 50 other countries, the European Commission, and 29 international organizations. NOAA also provides technical assistance and training to individuals from other countries, and participates in a visiting scientist program. In addition, environmental data is shared through NOAA participation in the World Data Center program.

In the future, NOAA will continue to direct its technology transfer and international collaboration activities toward four mission goals: 1. protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management; 2. understand climate variability and change to enhance society’s ability to plan and respond; 3. serve society’s needs for weather and water information; and 4. support the Nation’s commerce with information for safe, efficient, and environmentally-sound transportation.

III.2. Performance in FY 2007: Activities and Achievements

■ Collaborative Relationships for Research & Development

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● **CRADA**s, total active in the FY [1]	11	9	8	6	5
- New, executed in the FY	0	0	0	0	0
▪ Traditional CRADAs, [2] total active in the FY	11	9	8	6	5
- New, executed in the FY	0	0	0	0	0
▪ Non-traditional CRADAs, [3] total active in the FY	0	0	0	0	0
- New, executed in the FY	0	0	0	0	0
● **Other types of collaborative R&D relationships**	0	0	0	0	0

CRADA = Cooperative Research and Development Agreement.

(1) "Active" = legally in force at any time during the FY. "Total active" is comprehensive of all agreements executed under CRADA authority (15 USC 3710a).

(2) CRADAs involving collaborative research and development by a federal laboratory and non-federal partners.

(3) CRADAs used for special purposes -- such as, material transfer or technical assistance that may result in protected information.

■ Invention Disclosure and Patenting

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● New inventions disclosed in the FY [1]	5	2	1	4	3
● Patent applications filed in the FY [2]	0	0	1	0	1
● Patents issued in the FY	1	1	1	0	1

(1) Inventions arising at the federal lab.

(2) Tally includes U.S. patent applications, foreign patent applications filed on cases for which no U.S. application was filed, divisional applications, and continuation-in-part applications. Excludes provisional, continuation, duplicate foreign, and PCT applications.

■ Licensing

Profile of Active Licenses

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● **All licenses**, number total active in the FY [1]	5	5	4	5	6
▫ New, executed in the FY	2	0	0	1	3
▪ **Invention licenses**, total active in the FY	5	5	4	5	6
▫ New, executed in the FY	2	0	0	1	3
- Patent licenses, [2] total active in FY	5	5	4	5	6
▫ New, executed in the FY	2	0	0	1	3
- Material transfer licenses (inventions), total active	0	0	0	0	0
▫ New, executed in the FY	0	0	0	0	0
- Other invention licenses, total active in the FY	0	0	0	0	0

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
▫ New, executed in the FY	0	0	0	0	0
▪ **Other IP licenses**, total active in the FY	0	0	0	0	0
▫ New, executed in the FY	0	0	0	0	0
- Copyright licenses (fee bearing)					
▫ New, executed in the FY					
- Material transfer licenses (non-inventions), total active					
▫ New, executed in the FY					
- Other, total active in the FY					
▫ New, executed in the FY					

Multiple inventions in a single license are counted as one license. Licenses that include both patents and copyrights (hybrid licenses) are reported as patent licenses and are not included in the count of copyright licenses.

(1) "Active" = legally in force at any time during the FY.

(2) Patent license tally includes patent applications which are licensed.

Licensing Management

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● **Elapsed execution time**, (1) licenses granted in the FY					
▪ **Invention licenses**			**		
▫ Average, months	5.0	**	**	7.0	5.0
▫ Minimum	6.0				6.0
▫ Maximum	7.0				7.0
- Patent licenses (2)					
▫ Average, months	5.0	**	**	7.0	5.0
▫ Minimum	6.0				6.0
▫ Maximum	7.0				7.0
● **Licenses terminated for cause**, number in the FY					
▪ Invention licenses	0	0	0	0	0
- Patent licenses (2)	0	0	0	0	0

Data included in this table (intentionally) addresses only invention licenses, with patent licenses distinguished as a sub-class.

** No new licenses were executed in FY 2004 or FY 2005.

(1) Date of license application to the date of license execution. (Date of license application is the date the lab formally acknowledges the written request for a license from a prospective licensee and agrees to enter into negotiations.)

(2) Patent license tally includes patent applications which are licensed.

Characteristics of Licenses Bearing Income

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● **All income bearing licenses**, total number	5	5	4	5	4
▫ Exclusive	1	1	1	1	0
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	4	4	3	4	4
▪ **Invention licenses**, income bearing	5	5	4	5	4
▫ Exclusive	1	1	1	1	0
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	4	4	3	4	4
- Patent licenses, (1) income bearing	5	5	4	5	4
▫ Exclusive	1	1	1	1	0
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	4	4	3	4	4
▪ **Other IP licenses**, income bearing	0	0	0	0	0
▫ Exclusive					
▫ Partially exclusive					
▫ Non-exclusive					
- Copyright licenses (fee bearing)					
▫ Exclusive					
▫ Partially exclusive					
▫ Non-exclusive					
● **All royalty bearing licenses**, (2) total number	5	5	4	5	4
▪ **Invention licenses**, royalty bearing	5	5	4	5	4
- Patent licenses, (1) royalty bearing	5	5	4	5	4
▪ Other IP licenses, royalty bearing	0	0	0	0	0
- Copyright licenses (fee bearing)					

In general, license income can result from various sources: license issue fees, earned royalties, minimum annual royalties, paid-up license fees, and reimbursement for full-cost recovery of goods and services provided by the lab to the licensee including patent costs.

(1) Patent license tally includes patent applications which are licensed.

(2) Note that royalties are one component of total license income.

Income from Licenses

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● **Total income**, all licenses active in the FY [1]	$4,716	$24,961	$16,100	$13,100	$22,000
▪ **Invention licenses**	$4,716	$24,961	$16,100	$13,100	$22,000
- Patent licenses [2]	$4,716	$24,961	$16,100	$13,100	$22,000
▪ **Other IP licenses**, total active in the FY	0	0	0	0	
- Copyright licenses					
● **Total Earned Royalty Income** (ERI) [3]	$4,716	$24,961	$16,100	$13,100	$22,000
▫ Median ERI	$696	$1,923	$1,000	$1,000	$4,000
▫ Minimum ERI	$100	$116	$100	$100	$1,000
▫ Maximum ERI	$1,920	$21,000	$9,000	$5,000	$9,000
▫ ERI from top 1% of licenses	$1,920	$21,000	$9,000	$5,000	$9,000
▫ ERI from top 5% of licenses	$1,920	$21,000	$9,000	$5,000	$9,000
▫ ERI from top 20% of licenses	$1,920	$21,000	$9,000	$5,000	$9,000
▪ **Invention licenses**	$4,716	$24,961	$16,100	$13,100	$22,000
▫ Median ERI	$696	$1,923	$1,000	$1,000	$4,000
▫ Minimum ERI	$100	$116	$100	$100	$1,000
▫ Maximum ERI	$1,920	$21,000	$9,000	$5,000	$9,000
▫ ERI from top 1% of licenses	$1,920	$21,000	$9,000	$5,000	$9,000
▫ ERI from top 5% of licenses	$1,920	$21,000	$9,000	$5,000	$9,000
▫ ERI from top 20% of licenses	$1,920	$21,000	$9,000	$5,000	$9,000
- Patent licenses [2]	$4,716	$24,961	$16,100	$13,100	$22,000
▫ Median ERI	$696	$1,923	$1,000	$1,000	$4,000
▫ Minimum ERI	$100	$116	$100	$100	$1,000
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▫ ERI from top 5% of licenses	$1,920	$21,000	$9,000	$5,000	$9,000
▫ ERI from top 20% of licenses	$1,920	$21,000	$9,000	$5,000	$9,000
▪ **Other IP licenses**, total active in the FY	0	0	0	0	0
▫ Median ERI					
▫ Minimum ERI					
▫ Maximum ERI					
▫ ERI from top 1% of licenses					
▫ ERI from top 5% of licenses					
▫ ERI from top 20% of licenses					
- Copyright licenses					
▫ Median ERI					
▫ Minimum ERI					
▫ Maximum ERI					
▫ ERI from top 1% of licenses					

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
▫ ERI from top 5% of licenses					
▫ ERI from top 20% of licenses					

(1) Total income includes license issue fees, earned royalties, minimum annual royalties, paid-up license fees, and reimbursement for full-cost recovery of goods and services provided by the lab to the licensee including patent costs.

(2) Patent license tally includes patent applications which are licensed.

(3) "Earned royalty" = royalty based upon use of a licensed invention (usually, a percentage of sales or of units sold). Not a license issue fee or a minimum royalty.

Disposition of License Income

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● **Income distributed** (1)					
▪ **Invention licenses**, total distributed	$4,716	$24,961	$16,100	$13,100	$22,000
- To inventor(s)	$1,130 (24%)	$11,070 (44%)	$8,400 (52%)	$7,500 (57%)	$12,200 (55%)
- To other	$3,586 (76%)	$13,891 (56%)	$7,700 (48%)	$5,600 (43%)	$9,800 (45%)
- Patent licenses, (2) total distributed	$4,716	$24,961	$16,100	$13,100	$22,000
- To inventor(s)	$1,130 (24%)	$11,070 (44%)	$8,400 (52%)	$7,500 (57%)	$12,200 (55%)
- To other	$3,586 (76%)	$13,891 (56%)	$7,700 (48%)	$5,600 (43%)	$9,800 (45%)

Invention licenses are the chief policy interest regarding disposition of income; content of table reflects this focus.

(1) Income includes royalties and other payments received during the FY.

(2) Patent license tally includes patent applications which are licensed.

■Other Performance Measures Deemed Important by the Agency

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
Journal articles published	626	419	397	444	572
Technical reports published	245	300	226	148	176

GREAT LAKES ENVIRONMENTAL RESEARCH LABORATORY	FY 2007
Web Site Hits (html pages)	2,244,420
Web Site downloads (PDF pages) (brochures, research papers, technical memos, etc.)	65,740

OUTCOMES FROM TECHNOLOGY TRANSFER

For this year's annual report, the cases described below are provided as examples of downstream outcomes being achieved by NOAA technology transfer efforts:

● **New Tsunami Warning Stations Deployed**. The launch of the first Deep-ocean Assessment and Reporting of Tsunamis (DART) buoy station in the Indian Ocean in December 2006 marked an important milestone toward the goal of early detection and real-time reporting of tsunamis in the open ocean. Launched just a few weeks short of the second anniversary of the 2004 Boxing Day tsunami in Indonesia, the DART II buoy station brings important tsunami wave data to the region. One of the realities of the 2004 event was that the lack of real-time data made it very difficult to detect and warn of such an event. The DART system was developed by the NOAA Pacific Marine Environmental Laboratory, in Seattle, Washington. The stations consist of a bottom pressure sensor that is anchored to the seafloor and a companion moored surface buoy. An acoustic link transmits data from the bottom pressure sensor to the surface buoy. Then satellite links relay the data to ground stations. The result is tsunami detection that is communicated to forecasters in real-time. The new DART station will equip Indian Ocean countries with additional information to determine if and when to issue tsunami warnings. Thailand is responsible for the deployment and long-term maintenance as per a recently signed Memorandum of Agreement with NOAA. NOAA is also providing the region with technical leadership in building an end-to-end system by improving communications systems, establishing modeling and forecasting capabilities, building resilient communities, providing expertise in building regional and national operations centers, and training technical officials on various aspects of tsunami and multi-hazard warning operations. NOAA and the University of Washington trained tsunami warning and preparedness officials. The initial class included 31 participants from India, Indonesia, Thailand, Sri Lanka, and the Maldives.

The United States and Indonesia also launched a second Dart buoy in the Indian Ocean. The deployment was funded under a US Agency for International Development program (USAID) to make strategic investments in support of the Indian Ocean Tsunami Warning System (IOTWS). Using technology developed by NOAA, the Australian Bureau of Meteorology deployed its first Deep-ocean Assessment and Reporting of Tsunami buoy station. The DART station is in the southeast Tasman Sea some 1,200 kilometers from Tasmania.

Tsunamis: http://www.noaa.gov/tsunamis.html

Real-time DART Data: http://www.ndbc.noaa.gov/dart.shtml

● **In Record Wildfire Season, NOAA Satellites Aid U.S. Fire Managers**. The FY 2007 wildfire season in the United States set an all-time record with more than 9.8 million acres burned in more than 96,000 wildfires. NOAA satellites were key in detecting and monitoring the movement of the blazes, providing invaluable information to firefighters on the ground. Throughout the season, NOAA's two geostationary satellites and two polar-orbiting spacecraft provided more than 200 images each day. Along with satellite coverage, part of NOAA's operational fire and smoke program includes the Hazard Mapping System (HMS), which incorporates both NOAA and NASA satellites, tracks smoke from wildfires occurring throughout all of North America and pinpoints fires that are emitting the most smoke. HMS overlays fire locations with satellite imagery, providing analysts on the ground a high measure of quality control. The U.S. Forest Service, the Environmental Protection Agency, state and local land and

air quality managers and NOAA's National Weather Service, use fire and smoke products produced by NOAA.

Relevant Web Site: www.spc.noaa.gov/products/fire_wx/

●**NOAA Providing More Specific Warning Information for Severe Weather**. NOAA's National Weather Service began issuing more geographically specific warnings for tornadoes, severe thunderstorms, floods, and marine hazards. The new storm-based warnings will allow forecasters to pinpoint the specific area where the threats are highest, reducing the area warned by as much as 70 percent when compared to todays county-by-county system.

These are potentially deadly, short duration events that can develop very rapidly. NOAA's technology has evolved to support better warnings, and is adapting to meet public expectation to receive weather information on demand. By focusing the threat, NOAA can reduce the warned area by as much as 70 percent, which equates to more than $100 million in savings to the public. The real bottom line is that this will potentially save more lives. Eliminating areas needlessly warned builds confidence that you need to take action when a warning is issued. Storm-based warnings are displayed graphically and are extremely adaptable to cell phones, PDAs, and the Web. The Emergency Alert System is geared toward counties, and NOAA Weather Radio All Hazards will still alarm if there is a warning anywhere in the county. However, text and audio messages provide more specific information about where in the county the storm is, and the direction the storm is moving. Storm-based warnings reference landmarks such as highways, shopping centers, and parks, and use directional delimiters to indicate county location.

●**New Rapid Test for Domoic Acid**. NOAA scientists collaborated to develop and commercialize a rapid cost–effective new test to detect domoic acid. Domoic acid is a potent neurotoxin, produced by microalgae in the genus Pseudo-nitzschia. Domoic acid has been linked to mass mortalities of marine life including fish, seabirds, sea lions, and sea otters. This toxin concentrates in shellfish, including clams and crabs that people consume and poses a severe human health risk through poisoning and death. NOAA has been leading a research effort to develop and commercialize a more sensitive, low-cost, rapid test based on an enzyme-linked immunosorbent assay (ELISA). The development of programs to analyze the data, tests to determine the shelf life of the reagents and the development of the kit packaging for safe shipping and storage was done in association with an industry partner who will be responsible for commercialization of the DA test kits. NOAA's industry partner, Mercury Science, Inc., are producing the test kits at a price of ~$3.25 per sample, a 77 fold reduction of the cost of the old technique. In addition, NOAA provided training workshops to the Quileute tribe, the Quinault Nation, and State regulators in Washington and Oregon. NOAA also held workshops to demonstrate the proper use of the kits to researchers at the University of California Santa Cruz (UCSC) working to enhance California's domoic acid monitoring and to shellfish regulators at the California State Health Department. NOAA worked closely with General Counsel to assign the rights of invention, so the technology developed by this NOAA team in conjunction with its industry partner could be transferred to the private sector. This was a necessary step so the kits could be sold commercially. Future sales of the new test will dramatically improve monitoring of this important environmental toxin. The ability to reliably detect and monitor for domoic acid has wider implications in seafood imports, because domoic acid events, leading to mass mortalities of marine life, and reports of human illness are increasing worldwide. Numerous bloom events have now been reported in coastal regions from California to Chile, both coasts of Canada, and France.

●**NOAA Adds Wind Component to Coral Bleaching Warning System**. NOAA's Coral Reef Watch, a part of the NOAA Coral Reef Conservation Program, now offers a satellite-based experimental low winds product that improves the ability to assess and forecast coral bleaching events. Low wind conditions of less than five knots, commonly known as doldrums, can increase the temperature and light stress that contribute to coral bleaching. Winds promote mixing of the surface waters helping to cool the waters and deliver oxygen to corals and remove nutrients and waste products. Wind-generated waves also scatter light reducing incoming solar radiation to below harmful levels. During periods of sustained low winds, there is less mixing of shallow waters, higher temperatures and increased light penetration promoting environmental conditions adverse to corals, increasing the likelihood of bleaching. High temperatures and light cause corals to expel symbiotic micro-algae living in their tissues—algae that provide corals with food. Losing their algae leaves coral tissues devoid of color, and thus the coral appears to be bleached. Prolonged coral bleaching of more than a week can kill coral and eliminate the habitats needed for a range of marine life. The NOAA Coral Reef Watch Program gathers four-day mean surface wind data from the QuikSCAT satellite sensor. Persistent regions of low wind conditions are identified, and images and data are made available in a series of formats, including on Google Earth. The experimental doldrums product provides reef managers and the coral research community with important information on the way that wind conditions influence bleaching and coral reef communities. NOAA's bleaching alerts have proved useful to coral reef managers and researchers in monitoring environmental stresses impacting their reefs. With advance notice, officials can take measures to prevent human activity, such as diving, boating and recreational fishing, from adding to the stress of higher ocean temperatures already affecting the coral reefs.

See the Coral Reef Watch website at: www.coralreefwatch.noaa.gov/satellite/index.html

Information on other Agency Technology Transfer Activities

Data and Resources Available on NOAA Web Pages

NOAA makes available on its web pages large amounts of information and data for transfer to a wide variety of users. Some of the new or updated web pages are as follows:

● **CAMEO Chemicals**: NOAA's New Online Tool for Hazardous Materials Responders. A new online tool for first responders to hazardous chemical accidents has been released by NOAA's Office of Response and Restoration. The new Web site, CAMEO (Computer-Aided Management of Emergency Operations) Chemicals, is the latest component of NOAA's popular CAMEO software suite, and the first to be available for use online. CAMEO is the most widely used chemical response software in the world. It has already been placed in service with a major chemical release on the Mississippi River and a dangerous train derailment in New York. CAMEO Chemicals is an online, easy-to-use version of the most popular components of CAMEO, the chemical database and the reactivity prediction tool. Key features include:

- Extensive Chemical Database: CAMEO Chemicals uses the same chemical database as CAMEO, which contains response recommendations for over 6,000 chemicals. The database also contains more than 100,000 chemical synonyms and identification numbers, which aid emergency responders in identifying unknown substances during an incident.
- Critical Response Information: The revised search engine and new ranking order for search results makes finding chemicals easier. Data sheets on each chemical provide

physical properties, health hazards, information about air and water hazards, and recommendations for firefighting, first aid, and spill response.

- Chemical Reactivity: This tool predicts what hazards could arise if chemicals were to mix.

CAMEO Chemicals was developed by NOAA in partnership with the Environmental Protection Agency and the U.S. Coast Guard.

CAMEO Chemicals: http://cameochemicals.noaa.gov/

CAMEO Web site: http://www.epa.gov/ceppo/cameo/

NOAA's CAMEO information online: http://response.restoration.noaa.gov/cameo/cameo.html

●**Technology for Coastal Resource Managers**. The Cooperative Institute for Coastal and Estuarine technology (CICEET), a partnership of NOAA and the University of New Hampshire, is responsible for the development and commercial application of technologies that are used by a wide range of coastal resource managers—from the municipal to federal levels of government, in academia, and in the nonprofit and private sectors. CICEET administers nationally competitive funding opportunity programs that focus the expertise of leading scientists on the priority technology needs of coastal resource managers. The Environmental Technology Development (ETD) program has resulted in several commercially available technologies and others that are applied by the private sector to perform services to coastal resource management. Here are a few examples:

▪CICEET's investment in an automated radon mapping system for the assessment of submarine groundwater discharge has led to commercial product development and sales at Durridge, Inc. These products are being used widely by state and federal agencies to help communities develop nutrient budgets for the coastal zone and are proving especially useful in previously hard to monitor estuarine settings. End users of this system are affiliated with East Carolina, Florida State, and Louisiana State universities, Woods Hole Oceanographic Institution, and the U.S. Geological Survey (on behalf of state agencies). Internationally, it is being used in the United Kingdom, France, Monaco, Germany, Philippines, Thailand, Japan, China, Azerbaijan, Israel, on Australia's Great Barrier Reef, and Brazil. Prior to completing the grant, the investigator began to collaborate with Durridge on a data transfer and interface system that would help the technology become a useful and commercially viable product.

▪In response to CICEET's call for restoration technologies, researchers from Louisiana State University advanced a vertical-flow constructed wetland that breaks down harmful volatile organic compounds (VOCs) into harmless byproducts. Because of the wide variation in possible configurations for treating VOCs using wetlands, the technique was not patented. Instead, the project investigator worked to advance application with environmental services companies like ENSR/AECOM and General Physics Corp, as well as hazardous waste site managers in Louisiana, Minnesota, Michigan, Massachusetts, Maryland, Connecticut, North Carolina, and Tennessee. Because traditional remediation can be costly and maintenance-intensive, site managers and companies have been very receptive to this approach, which relies on natural processes to treat contaminants in place. For example, ENSR/AECOM is using the vertical constructed wetland to address VOC-contaminated groundwater that threatens a drinking water reservoir in North Carolina, and predict they will use this approach widely in the future.

▪Serial grant awards from CICEET's ETD allowed researchers from the University of Rhode Island to collaborate with SubChem Systems, Inc., to develop a commercially available nutrient monitoring system that includes the SubChemPak Analyzer, the XZ-Profiler towed chemical measurement system, and the SubChem Analyzer payload for REMUS, a remote environmental monitoring unit. The system is able to assess seasonal and episodic events such as tidal and wind driven-currents, rainstorms, channel dredging, and ship activity that may lead to sediments resuspension and significant changes in the concentration of dissolved oxygen, chemical contaminants, and nutrients in coastal waters. SubChem Systems has sold these technologies to 13 environmental research labs, including Florida's Mote Marine Laboratory.

●**NOAA Launches Local Three-Month Temperature Outlook**. In response to customer demand for climate information at the local level, the NOAA National Weather Service launched a new local three-month temperature outlook product for the continental United States. This product allows individuals and businesses to have reliable information to make important economic decisions, and has valuable tools to aid decision-makers in managing risks and opportunities at the regional and local level. Easily accessed on the Internet, the local three-month temperature outlook extends the NOAA Climate Prediction Center's national three-month temperature outlook to specific local sites, providing probabilistic forecasts of the average daily mean temperatures for 13 consecutive overlapping three-month periods (e.g. January-February-March, February-March-April). It is available for approximately 1,150 sites nationwide. The information is released on the third Thursday of every month. The local three-month temperature outlook can be accessed from the NOAA National Weather Service Web page at: www.nws.noaa.gov/predictions.php

●**Powerful New Tool to Track Atmospheric Carbon Dioxide by Source**. Scientists from NOAA have a new tool to monitor changes in atmospheric carbon dioxide and other greenhouse gases by region and source. The tool, called CarbonTracker, will enable its users to evaluate the effectiveness of their efforts to reduce or store carbon emissions. The online data framework distinguishes between changes in the natural carbon cycle and those occurring in human-produced fossil fuel emissions. It also provides verification for scientists using computer models to project future climate change. Users include corporations, cities, states and nations assessing their efforts to reduce or store fossil fuel emissions around the world. CarbonTracker distills an accurate assessment of greenhouse-gas increases or decreases. The resolution will increase to observe differences in concentration on finer geographical scales over time as data become available. Using the limited data that currently exist, the model can characterize emissions each month among U.S. regions, such as the West or the Southeast. As the observation network becomes denser, however, policymakers will be able to check the CarbonTracker Web site to compare emissions from urban centers. For instance, the resolution will be fine enough to determine the difference in net emissions from Sacramento as compared to San Francisco. One of the system's most powerful assets is its ability to detect natural variations in carbon uptake and release by oceans and vegetation, which could either aid or counteract societies' efforts to curb fossil fuel emissions on a seasonal basis. NOAA collaborates with partners in France, Australia, Brazil and other nations to measure greenhouse gases globally. Through a longstanding collaboration, Environment Canada has provided a quarter of the data for North America.

Relevant Web Site: www.esrl.noaa.gov/gmd/ccgg/carbontracker

●**New Federal Plan Keeps Air Travelers Safe from Volcanic Ash**. Federal agencies involved with aviation, volcanoes and weather have created a new way to work together to track volcanic ash plumes and report the risks to the aviation community and keep air travelers out of harm's way. Volcanic ash can cause aircraft engines to fail or damage navigational instruments. The plan, "National Volcanic Ash Operations Plan for Aviation," will improve the safety of flight operations in U.S.-controlled airspace. It defines agency responsibilities, provides a comprehensive description of an interagency standard for volcanic–ash-related observations, advisories, warnings, notices, and forecasts, as well as their formats. It also describes the agency backup procedures for operational products, and outlines the actions each agency will follow during a volcanic eruption that subsequently affects aviation services. The United States is one of the most volcanically rich countries in the world with 169 active and dormant volcanoes. Many of these volcanoes are capable of erupting explosively and ejecting volcanic ash high into busy air routes. When a volcanic ash hazard looms, advanced warning and coordinated efforts to share information among scientists, air traffic controllers, dispatchers and pilots can make a crucial difference in saving lives and protecting property. This plan helps achieve the goal of averting encounters of aircrafts with damaging ash clouds. The risks to aviation from airborne volcanic ash include degraded engine performance, flameouts, loss of visibility, failure of critical navigational and operational instruments and loss of life. Damages up to $80 million have occurred to a single aircraft. Aircraft encountering less dense volcanic ash clouds can incur longer-term costs due to increased maintenance of engines and external surfaces. The plan was prepared and published by the Federal Coordinator for Meteorological Services and Supporting Research after a series of working group meetings among the Federal Aviation Administration, U.S. Air Force, NOAA, the U.S. Geological Survey, the National Aeronautics and Space Administration, and the Smithsonian Institution's National Museum of Natural History. The Air Line Pilots Association also participated in the development of the plan. The plan can be found Online at:

http://www.ofcm.gov/p35-nvaopa/fcm-p35.htm

Appendix

Progress in the Agency's Performance Metrics for Technology Transfer

In future reports, the agency will list mission-related data that addresses NOAA's primary technology transfer mechanism, which is the open dissemination of its products and services. Presentations at scientific meetings, collaborative research (other than CRADAs), visiting scientists, data exchange agreements, numbers of data requests received by NOAA's environmental data centers, and external agency studies are being investigated as metrics for reporting this aspect of NOAA's technology transfer activities. Annual figures for the number of publications in scientific journals and NOAA technical reports are already included.

IV. NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION--INSTITUTE FOR TELECOMMUNICATION SCIENCES

Technology Transfer at the Agency's Federal Laboratories – Approach and Plans, FY 2007 Activities and Achievements

IV.1. Agency Approach and Plans for Technology Transfer

The Institute for Telecommunication Sciences (ITS) is the chief research and engineering arm of the National Telecommunications and Information Administration (NTIA).

ITS supports such NTIA telecommunications objectives as promotion of advanced telecommunications and information infrastructure development in the United States, enhancement of domestic competitiveness, improvement of foreign trade opportunities for U.S. telecommunications firms, and facilitation of more efficient and effective use of the radio spectrum. ITS also serves as a principal federal resource for solving the telecommunications concerns of other federal agencies, state and local governments, private corporations and associations, and international organizations.

ITS uses three principal means for achieving technology transfer: cooperative research and development, technical publications, and leadership and technical contributions in the development of telecommunications standards.

Cooperative research and development. Cooperative research and development agreements (CRADAs), based upon the Federal Technology Transfer Act (FTTA) of 1986, are a principal means through which ITS aids the private sector. The FTTA provides the legal basis for and encourages shared use of government facilities and resources with the private sector in advanced telecommunications technologies.

These partnerships aid in the commercialization of new products and services as well as enhance the capabilities of ITS laboratories. They also provide insights into industry's needs for productivity growth and competitiveness enabling ITS to adjust the focus and direction of its programs for effectiveness and value.

In FY 2007, ITS participated in technology transfer and commercialization efforts by fostering cooperative telecommunications research with industry where benefits can directly facilitate U.S. competitiveness and market opportunities. These efforts will continue in future years. ITS also participated – as it has for a number of years – in CRADAs with private sector organizations to design, develop, test, and evaluate advanced telecommunication concepts. The private industry partner benefits through such cooperative relationships, as does the Institute, as it is able to undertake research in commercially important areas that it would not otherwise be able to do.

To date, major contributions to personal communication services (PCS), local multipoint distribution service (LMDS), ultrawideband (UWB), and Broadband over Power Line (BPL) technologies have been achieved through CRADAs. These have aided U.S. efforts to rapidly introduce new socially beneficial communications technologies. More recently, CRADAs in the

areas of objective audio and video quality and advanced antennas for wireless systems have allowed ITS to contribute to the development of new products and services.

In addition, ITS plans to continue using patents to secure intellectual property rights in laboratory innovations with commercial promise. ITS plans to advance its mission and benefit the competitiveness of U.S. industry by pursuing opportunities to commercially license patents to CRADA partners and other interested parties. As an example, ITS has developed software implementing a video quality metric for commercial development. This software incorporates technology covered by three patents. Evaluation software was requested by 176 parties in FY 2007 for testing purposes. This year ITS has made commercial licenses available to everyone free of charge. Anyone interested in downloading the VQM software will be able to submit an application for a free commercial license from our website. All VQM files, including source code, will be available for download.

Technical publications. Publication has, historically, been the means through which ITS has transferred research results to other researchers, the commercial sector, and government agencies. Many of these publications – both internal reports and monographs and external, peer reviewed, scientific journal articles – have become standard references in several telecommunications areas.

Technical publication remains at present a principal means for ITS' technology transfer. Most of these technical publications are released only after going through an internal peer review process managed by the ITS Editorial Review Board (ERB). Of the publications released through the ERB process in recent years, approximately one half were approved for external publication in the scientific literature.

Development of telecommunication standards. This third principal means of ITS technology transfer directly addresses improvement of U.S. competitiveness in telecommunications. For several decades, ITS has provided leadership and technical contributions to organizations, both national and international, responsible for developing telecommunication standards. For example, a plurality of the technical recommendations of the International Telecommunication Union (ITU – a treaty organization) are based on research conducted at ITS. Also, key national quality of service standards developed under the American National Standards Institute (ANSI) T1 committee for video, audio, and digital data incorporate research results obtained at ITS.

ITS continues to chair numerous committees and working groups in the ITU, ANSI T1 (now ATIS – Alliance for Telecommunications Industry Solutions), and other telecommunication standards organizations, providing technical leadership that is trusted by the commercial sector participants. ITS' technical inputs are relied upon as technically advanced and sound, and unbiased by commercial interests.

In FY 2007, ITS continued its technical leadership and contributions to communications standards for public safety, particularly for first responders. ITS' primary area of contribution has been interoperability standards and testing procedures. ITS' objective video quality measurement method has been made a national standard by ANSI. ITS' method was also the best performing metric in comparison testing by the ITU with other methods from around the world.

IV.2. Performance in FY 2007: Activities and Achievements

■ Collaborative Relationships for Research & Development

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● **CRADA**s, total active in the FY [1]	239	319	278	514	285
- New, executed in the FY	178	185	185	512	280
▪ Traditional CRADAs ,[2] total active in the FY	5	7	7	8	9
- New, executed in the FY	0	3	5	6	4
▪ Non-traditional CRADAs, [3] total active in FY	234	312	273	506	276
- New, executed in the FY	178	182	144	506	276
● Other types of collaborative R&D relationships					
▪ Collaborative standards contributions, [4] total	2	11	11	16	25
-New, executed in the FY	1	0	0	5	9

CRADA = Cooperative Research and Development Agreement.

-- = Data not requested from agency in reports of last years.

(1) "Active" = legally in force at any time during the FY. "Total active" is comprehensive of all agreements executed under CRADA authority (15 USC 3710a).

(2) CRADAs involving collaborative research and development by a federal laboratory and non-federal partners.

(3) ITS' Telecommunications Analysis Services (TA Services) is Internet accessible through Web-based electronic CRADAs. TA Services provides analysis support to private industry and public agencies in the areas of wireless system design and evaluation, and site selection. The service is provided on a cost-reimbursable basis, 24 hours a day/7 days a week throughout the year. TA Services currently reaches numerous government and private sector users across the nation, providing the latest versions of ITS-developed telecommunications models, databases, and tools. Use of the CRADA makes TA Services available to users in a short time and on a cost reimbursable basis. Additionally, CRADA partners provide useful evaluations of the ITS software used. This information aids ITS to improve existing software tools for wireless system design and analysis and to develop new ones – benefiting both ITS' own research capabilities and the resources that outside users can draw upon. The CRADA agreement also allows ITS to gain valuable insights from users' feedback about the rapidly changing needs of industry and government in telecommunications technology.

(4) ITS works with industry, through a number of standards fora, to apply research results to the development of telecommunication performance standards and guidelines. In FY 2007, ITS worked collaboratively with the International Telecommunication Union, the Telecommunications Industry Association, the Alliance for Telecommunications Industry Solutions, and various Federal public safety groups to interpret and analyze standards and regulations.

■ Invention Disclosure and Patenting

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● New inventions disclosed in the FY [1]	0	0	1	0	0
● Patent applications filed in the FY [2]	0	0	0	1	0
● Patents issued in the FY	1	0	0	1	0
● Active patents, end of the FY	6	6	6	8	7

(1) New invention disclosed and provisional patent filed.

(2) Tally includes: U.S. patent applications, foreign patent applications filed on cases for which no U.S. application was filed, divisional applications, and continuation-in-part applications. Excludes: provisional, continuation, duplicate foreign, and PCT applications.

■ Licensing

Profile of Active Licenses

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● **All licenses**, number total active in the FY [1]	57	98	103	82	186
▫ New, executed in the FY	54	98	103	79	179
▪ **Invention licenses**, total active in the FY	57	98	103	82	186
▫ New, executed in the FY	54	98	103	79	179
- Patent licenses, [2] total active in FY	57	3	3	7	10
▫ New, executed in the FY	54	3	0	4	3
- Material transfer licenses (inventions), total	0	0	0	0	0
▫ New, executed in the FY	0	0	0	0	0
- Other invention licenses, [3] total active in the	0	95	100	75	176
▫ New, executed in the FY	0	95	100	75	176
▪ **Other IP licenses**, total active in the FY	0	0	0	0	0
▫ New, executed in the FY	0	0	0	0	0
- Copyright licenses (fee bearing)					
▫ New, executed in the FY					
- Material transfer licenses (non-inventions), total active					
▫ New, executed in the FY					
- Other, total active in the FY					
▫ New, executed in the FY					

Multiple inventions in a single license are counted as one license. Licenses that include both patents and copyrights (hybrid licenses) are reported as patent licenses and not included in the count of copyright licenses.

(1) "Active" = legally in force at any time during the FY.
(2) Patent license tally includes patent applications which are licensed.
(3) International copyright licenses (non fee bearing) for VQM technology

Licensing Management

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● **Elapsed execution time**, [1] licenses granted in the FY					
▪ **Invention licenses**					
▫ Average (or median), months	1.0	2.0	2.0	1.5	1.0
▫ Minimum	1.0	1.0	1.0	1.0	0.5
▫ Maximum	1.0	3.0	3.0	2.0	1.5
- Patent licenses [2]					
▫ Average (or median), months	1.0	2.0	2.0	1.5	1.0
▫ Minimum	1.0	1.0	1.0	1.0	0.5
▫ Maximum	1.0	3.0	3.0	2.0	1.5
● **Licenses terminated for cause**, number in the FY					
▪ **Invention licenses**	0	0	0	0	0
- Patent licenses [2]	0	0	0	0	0

Data included in this table (intentionally) addresses only invention licenses, with patent licenses distinguished as a sub-class.

(1) Date of license application to the date of license execution. (Date of license application is the date the lab formally acknowledges the written request for a license from a prospective licensee and agrees to enter into negotiations.)

(2) Patent license tally includes patent applications which are licensed.

Characteristics of Licenses Bearing Income

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● **All income bearing licenses**, total number	3	3	4	7	10
▫ Exclusive	0	0	0	0	0
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	3	3	4	7	10
▪ **Invention licenses**, income bearing	3	3	4	7	10
▫ Exclusive	0	0	0	0	0
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	3	3	4	7	10
- Patent licenses, (1) income bearing	3	3	4	7	10
▫ Exclusive	0	0	0	0	0
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	3	3	4	7	10
▪ **Other IP licenses**, income bearing	0	0	0	0	0
▫ Exclusive					
▫ Partially exclusive					
▫ Non-exclusive					
- Copyright licenses (fee bearing)	0	0	0	0	0
▫ Exclusive					
▫ Partially exclusive					
▫ Non-exclusive					
● **All royalty bearing licenses**, (2) total number	0	3	4	7	10
▪ **Invention licenses**, royalty bearing	0	3	4	7	10
- Patent licenses, (1) royalty bearing	0	3	4	7	10
▪ **Other IP licenses**, royalty bearing	0	0	0	0	0
- Copyright licenses (fee bearing)					

In general, license income can result from various sources: license issue fees, earned royalties, minimum annual royalties, paid-up license fees, and reimbursement for full-cost recovery of goods and services provided by the lab to the licensee including patent costs.

(1) Patent license tally includes patent applications which are licensed.

(2) Note that royalties are one component of total license income.

Income from Licenses

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● **Total income, all licenses active in the FY** (1)	$0	$33,500	$7,212	$24,500	$7,500
▪ **Invention licenses**	$0	$33,500	$7,212	$24,500	$7,500
- Patent licenses (2)	$0	$33,500	$7,212	$24,500	$7,500
▪ **Other IP licenses**, all active licenses in FY	$0	$0	$0	$0	$0
- Copyright licenses					
● **Total Earned Royalty Income** (ERI) (3)	$0	$0	$0	$0	$0
▪ **Invention licenses**	$0	$0	$0	$0	$0
- Patent licenses (2)	$0	$0	$0	$0	$0
▫ Median ERI					
▫ Minimum ERI					
▫ Maximum ERI					
▫ ERI from top 1% of licenses					
▫ ERI from top 5% of licenses					
▫ ERI from top 20% of licenses					
▪ **Other IP licenses**, total active in the FY	$0	$0	$0	$0	$0
▫ Median ERI					
▫ Minimum ERI					
▫ Maximum ERI					
▫ ERI from top 1% of licenses					
▫ ERI from top 5% of licenses					
▫ ERI from top 20% of licenses					
- Copyright licenses					
▫ Median ERI					
▫ Minimum ERI					
▫ Maximum ERI					
▫ ERI from top 1% of licenses					
▫ ERI from top 5% of licenses					
▫ ERI from top 20% of licenses					

(1) Total income includes license issue fees, earned royalties, minimum annual royalties, paid-up license fees, and reimbursement for full-cost recovery of goods and services provided by the lab to the licensee including patent costs.

(2) Patent license tally includes patent applications which are licensed.

(3) Earned royalty" = royalty based upon use of a licensed invention (usually, a percentage of sales or of units sold). Not a license issue fee or a minimum royalty.

Disposition of License Income

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
● **Income distributed** [1]					
▪ **Invention licenses**, total distributed	$0	$33,500	$7,212	$24,500	$7,500
- To inventor(s)	$0	$18,450 (55%)	$3,564 (49%)	$15,750 (64%)	$5,050 (67%)
- To other [3]	$0	15,050 (45%)	$3,648 (51%)	$8,750 (36%)	$2,450 (33%)
- Patent licenses, [2] total distributed	$0	$33,500	$7,212	$24,500	$7,500
- To inventor(s)	$0	$18,450 (55%)	$3,564 (49%)	$15,750 (64%)	$5,050 (67%)
- To other [3]	$0	$15,050 (45%)	$3,648 (51%)	$8,750 (36%)	$2,450 (33%)

Invention licenses are the chief policy interest regarding disposition of income; the content of this table reflects this focus.

(1) Income includes royalties and other payments received during the FY.
(2) Patent license tally includes patent applications which are licensed.
(3) To ITS/NTIA

■ Other Performance Measures Deemed Important by the Agency

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
Technical publications produced	20	17	19	8	3
Total number of hits on online publications	--	--	--	1,116,573	1,426,125

-- = Data not requested from agency in reports of last years.

See "Technical Publications" above in the first section of this report for additional information on this topic.

■ Outcomes from Technology Transfer

For this year's annual report, the cases described below are provided as examples of the downstream outcomes being achieved by ITS technology transfer efforts:

• **Video quality metric**. ITS has developed a superior method of measuring video quality objectively that closely predicts the quality that human viewers would perceive subjectively. The technology is covered by four patents owned by ITS/NTIA. In FY 2003, the ITS method was adopted by ANSI as a U.S. national standard. In addition, the ITU tested a number of proposed video quality metrics from around the world and found the ITS method superior. ITS' method became an international standard in 2004, as approved by the ITU. Also in FY 2004, the Federal Laboratory Consortium presented ITS with an award for its efforts to disseminate this technology both nationally and internationally. ITS filed another patent on a new version of the video quality metric in FY 2006. ITS also received a registered trademark for the video quality metric logo in FY 2007. 176 VQM evaluation licenses were downloaded during the 2007 fiscal year. In FY 2007 ITS decided to make VQM software commercial licenses available for free. This will increase distribution dramatically. ITS is working on setting up a website to take

applications for free VQM commercial licenses. The website should be up and running by January 2008.

• **Table Mountain Research**. The Table Mountain Field Site and Radio Quiet Zone supports fundamental research into the nature, interaction, and evaluation of telecommunication devices, systems, and services. Each year, private companies, universities, and other organizations conduct research at Table Mountain under Cooperative Research and Development Agreements (CRADAs). Brief descriptions of some of these recent CRADAs follow.

For the past two years the University of Colorado's Research and Engineering Center for Unmanned Vehicles has conducted measurements of the performance of ad hoc wireless networks with both ground-based and airborne terminals at Table Mountain. In FY 2006, a small local company known as Johnson's Jobs performed antenna testing at the Table Mountain turntable facility under a CRADA. Another small company, RF Metrics, performed research under a CRADA entitled "A Study of the Use of a New Antenna Pattern Collection Technique for Radar Emissions." Lockheed Martin Coherent Technologies is currently in the middle of a year-long CRADA to perform field-testing and characterization of components, subsystems, and systems for eyesafe coherent laser radar.

Appendix:

Progress in Improving the Agency's Performance Metrics for Tech Transfer

ITS' annual performance reporting has been revised to conform to the Department of Commerce guidelines. Starting in 2003, ITS added a new metric under the "Other Performance Measures" category: number of publications approved through the Editorial Review Board (ERB) process. While not perfect, this metric provides a useful, working indicator of the number of quality publications released to the public. In 2004, ITS added another measure, participation on standards committees. In 2006, ITS added another metric; one that more directly provides an indication of ultimate benefit to the public. The new metric is the total number of hits on the publications listed on the "ITS Online Documents."