Annual Report on Technology Transfer: Approach and Plans, Fiscal Year 2009 Activities and Achievements

U.S. Department of Commerce

Report prepared by:

National Institute of Standards and Technology
National Oceanic and Atmospheric Administration
National Telecommunications and Information Administration—Institute for Telecommunication Sciences

In response to the:
Technology Transfer and Commercialization Act of 2000 (P.L. 106-404)

September 2010

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FOREWORD

This report summarizes the technology transfer activities and achievements of the Department of Commerce's Federal laboratories for fiscal year (FY) 2009. At the Department of Commerce, technology transfer is a significant part of the mission and program activities of the National Institute of Standards and Technology (NIST), the National Oceanic and Atmospheric Administration (NOAA), and the National Telecommunications and Information Administration's (NTIA) Institute for Telecommunication Sciences (ITS). Accordingly, this report focuses on the activities of those three agencies.

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.

The major sections of this report are organized to summarize the respective agencies' technology transfer approaches and plans, and to provide specific information about the agencies' activities and accomplishments for FY 2005 through FY 2009. 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. An electronic version of this report and versions from previous fiscal years are available online at http://patapsco.nist.gov/ts/220/external/index.htm.

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CHAPTER 1

Department of Commerce Overview and Summary

The Department of Commerce works in partnership with businesses, universities, and communities 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.

The Department conducts research and development (R&D) in numerous areas of contemporary science and technology at the National Institute of Standards and Technology (NIST), at the laboratory facilities across the National Oceanic and Atmospheric Administration (NOAA), and at the National Telecommunications and Information Administration's (NTIA) Institute for Telecommunication Sciences (ITS). Technology transfer is a key part of the program activities in each of these agencies' Federal laboratory systems.

Agency Missions and Channels for Technology Transfer

Mission	Technology 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.	▪ NIST carries out its mission by working 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. Accordingly, NIST draws on a diverse set of mechanisms to transfer the knowledge and technologies that result from its laboratory research. ▪ Principal technology transfer mechanisms: ○ Technical publications, ○ Standard Reference Materials ○ Standard Reference Data ○ Calibration services ○ Technical Support for documentary standards ○ Cooperative Research and Development Agreements (CRADAs) ○ Patents and licenses ○ Software tools ○ Conferences, workshops, and inquiries ○ Guest researchers and facilities users

Mission	Technology 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 technology transfer involves direct transfer, licensing intellectual property, and cooperative research relationships with industry. ▪ Principal technology 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 technology transfer and commercialization by fostering cooperative research with industry where benefits can directly facilitate U.S. competitiveness and market opportunities. ▪ Principal technology transfer mechanisms: ○ Telecommunications analysis services ○ Technical publications ○ Development of telecommunications standards ○ CRADAs ○ Patents and licenses

Summary of Technology Transfer Activities Across the Department, FY 2005 – FY 2009

■ Selected Measures Active in Each Fiscal Year

Collaborative Relationships for Research and Development

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● CRADAs					
▪ Traditional CRADAs					
NIST	65	135	140	121	65[3]
NOAA	8	6	5	4	5
ITS	7	8	9	6	7
Department	80	149	154	131	77
▪ Non-traditional CRADAs					
NIST	1,553	2,353	2,348	2,224	2,284
ITS	273	506	276	35[1]	25
Department	1,826	2,895	2,510	2,259	2,309
● Other types of collaborative R&D relationships					
▪ NIST - Facility Use Agreements	588	639	717[2]	635	760
▪ NIST - Guest scientists and engineers	2,115	2,114	2,672	2,816	2,828
▪ ITS - Collaborative contributions	11	16	25	25	20

CRADA = Cooperative Research and Development Agreement

(1) In 2008, ITS removed from the Web some of its telecommunication analysis services. These services provided network-based access to research results, models, and databases supporting applications in wireless system design and analysis. As a result, the number of CRADAs between the government and industry that allowed for improvement to these models decreased significantly. ITS is working on a newer geographic information system- (GIS-) based platform for the modeling services, which will be available in future years.

(2) Reflects correction of data from FY 2007 Report.

(3) Decrease in CRADAs attributed to successful conclusion of CRADA Consortiums.

Invention Disclosure and Patenting

		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● New inventions disclosed	NIST	19	10	29	40	36
	NOAA	1	4	3	0	4
	ITS	1	0	0	0	0
	Department	23	14	32	40	40
● Patent applications filed	NIST	5	4	6	18	18
	NOAA	1	0	2	3	1
	ITS	0	1	0	0	0
	Department	6	5	8 [1]	21	19
● Patents issued	NIST	9	6	3	1	7
	NOAA	1	0	0 [1]	1	0
	ITS	0	1	0	0	0
	Department	10	7	3	2	7

(1) Reflects correction of data from FY 2007 Report.

Licensing – Profile of Active Licenses

		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **All Department of Commerce licenses**		133	111[2]	222[2]	29	40
Patent licenses	NIST	26	24[2]	30[2]	23	33
	NOAA	4	5	6	6	7
	ITS	3	7	10	0[1]	0
	Department	33	35	46[2]	29	40
Other invention licenses	ITS	100	75	176[2]	0	0

(1) This number of licenses is zero because ITS no longer licenses Video Quality Metric (VQM) technology. Instead, ITS has made this software freely available via open-source download.
(2) Reflects correction of data from FY 2008 Report.

Characteristics of Licenses Bearing Income

		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **All income-bearing licenses**	Department	25	30	35	25	27
▪ **Invention licenses**	Department	25	30	35	25	27
- Patent licenses	NIST	17	18	21	21	22
	NOAA	4	5	4	4	5
	ITS	4	7	10	0	0
	Department	25	30	35	25	27
▫ Exclusive, partially exclusive, non-exclusive	NIST	11, 0, 6	16, 0, 2	16, 0, 5	14, 0, 7	15, 0, 7
	NOAA	1, 0, 3	1, 0, 4	0, 0, 4	0, 0, 4	0, 0, 5
	ITS	0, 0, 4	0, 0, 7	0, 0, 10	0, 0, 0	0, 0, 0
	Department	12, 0, 13	17, 0, 13	16, 0, 19	14, 0, 11	15, 0, 12

Income from Licensing

		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **Total income**	Department	$146,660	$194,393	$224,847	$292,647	$335,889
	NIST	$123,348	$156,793	$195,347	$223,640	$197,445
	NOAA	$16,100	$13,100	$22,000	$69,007	$138,444[2]
	ITS	$7,212	$24,500	$7,500	$0[1]	$0

(1) The dollar amount for licenses is zero because ITS no longer licenses Video Quality Metric (VQM) technology. Instead, ITS has made this software available via open-source download.
(2) Increase is due to a license with The Walt Disney Company for NOAA's Science on a Sphere for a one-time royalty of $75,000.

Agency-Specific Important Mechanisms for Technology and Knowledge Transfer

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
Standard Reference Materials (SRMs) available – NIST	1,246	1,302	1,285	1,282	1,283
Standard Reference Materials (SRMs) units sold – NIST	32,163	31,195	32,614	33,373	29,769
Standard Reference Data (SRD) titles available – NIST	110	113	109	102	120
Number of calibration tests performed – NIST	12,849	13,127	27,489 (1)	25,944 (1)	18,609
Technical publications in peer-reviewed journals – NIST	1,148	1,163	1,272	1,271	1,463
Journal articles published – NOAA	397	444	584 (2)	515	631
Technical reports published – NOAA	226	148	196 (2)	103	134
Technical publications produced – ITS	19	8	3	15	12

(1) The number of calibration tests performed in FY 2007 was significantly different than the number of tests performed in FY 2004, FY 2005, and FY 2006, due principally to a surge in calibration testing for the military and its contractors.
(2) Reflects correction of data from FY 2007 Report.

Further details 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 annual report provides a comprehensive set of statistics on the technology transfer activities of each of the Department's agencies with Federal laboratory operations. This information covers cooperative research and development relationships, invention disclosure and patenting, licensing, and other technology transfer mechanisms. This report also highlights examples of downstream results (e.g., commercially significant technologies) from these Federal laboratory technology transfer activities. The content and format of this year's performance report is consistent with the guidelines issued for the annual performance reporting by the Office of Management and Budget in its August 2009 edition of Circular A-11.

Across the Department, technology transfer involves a good deal more than cooperative R&D, patenting, and licensing. The other mechanisms include technology transfer through technical publications, technical support development for industrial standards and materials, other forms of public dissemination, and opportunities for guest scientists and engineers from across the United States to participate in Federal laboratory activities. Statistics and descriptions for such other mechanisms of technology transfer are included, as part of the agencies' technology transfer efforts.

The Department continues to explore the development of better metrics for program performance. The information presented in this report is based upon a stable framework of metrics that has been used traditionally to evaluate the effectiveness of technology transfer. In future reports, the Department will consider including additional metrics as needed. Specific initiatives under way at each agency are described in Chapters 2, 3, and 4 of this report.

CHAPTER 2

National Institute of Standards and Technology

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 the quality of life.

An essential part of NIST's work is anticipating 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 technologies and services that support U.S. industry, scientific research, and the activities of many other 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 interested parties. In order to provide leading-edge scientific and technical work, NIST is required to have expertise in multiple disciplines, to maintain high levels of collaboration among organizations and people with diverse capabilities, and to have highly specialized facilities and tools. For more than a century, the NIST laboratories have successfully collaborated with others to provide the measurement techniques and technical tools needed by America's innovators. NIST uses many different collaboration mechanisms to promote innovation and to ensure that the resulting knowledge and infrastructural technologies are broadly disseminated.

The principal mechanisms NIST uses to transfer its knowledge, intellectual property, and other technical assets are: research and development collaborations with industry, academia, and other government agencies; publishing in peer-reviewed publications; Standard Reference Materials and Standard Reference Data; participating in the research and development of industry "road maps"; organizing and hosting conferences and workshops; hosting U.S. and international guest scientists from industry, academia, and other government agencies; making its advanced facilities available to other scientists through Facility Use Agreements; entering into formal research agreements such as Cooperative Research and Development Agreements (CRADAs); and obtaining and licensing patents when such is deemed important for effective technology transfer. NIST also devotes considerable attention to publicizing its planned, ongoing, and completed work in the trade and technical presses, in order to reach the organizations most likely to have an interest in utilizing the results of NIST's work and availing themselves of the agency's research, facilities and services.

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

The present array of metrics covers the wide variety of mechanisms that NIST uses to ensure

effective technology transfer. In recent years, NIST has improved its patent and licensing policies and practices through the creation of a Patent Review Committee in an effort to sharpen patent strategy and utilize resources more efficiently; NIST has provided formal intellectual property training sessions at facilities in both Gaithersburg, Maryland, and Boulder, Colorado; and has implemented a new Small Business Innovation Research (SBIR) Technology Transfer Program to actively stimulate commercialization of nascent technologies. NIST also works with a coalition of the private sector and Federal, State, and local government agencies in a highly successful program to facilitate technology transfer through postdoctoral STEM (science, technology, engineering, and mathematics) fellows serving term appointments in Federal laboratories. In FY 2010, NIST will continue to participate in this and other programs to expand its technology transfer collaborations with regional economic development entities and with venture capital and other groups as well as through the Manufacturing Extension Partnership (MEP) network, which reaches over 10,000 manufacturing entities in the U.S.

In addition to the technology transfer activity metrics, NIST consistently assesses the downstream impact of its research projects and infratechnologies. NIST evaluates its programmatic performance over time by utilizing a diverse yet complementary set of performance indicators and measures. NIST has designed its performance evaluation system to accommodate the Institute's diverse products as well as to address the intrinsic difficulty of measuring the results of Federal investments in scientific and technological products and services. NIST evaluates its performance and plans its work through several distinct evaluation methods: economic impact studies, peer review and other forms of external assessment, customer feedback, and quantitative output metrics. Over the 9-year period, 2000-2009, 14 economic impact studies were conducted of NIST research programs. NIST reports its performance through Department of Commerce Government Performance and Results Act of 1993 (GPRA) documents as well as through the NIST Financial Statements. These studies show that for NIST research, the ratio of overall return on investment is 36:1. Additional details on NIST economic performance measures are available online at http://www.nist.gov/director/planning/impact_assessment.htm#recent.

Technology Transfer Methods

● Patents and Licensing

NIST's Office of Technology Partnerships (OTP) leads an ongoing program of informational sessions and meetings to communicate to NIST staff the importance of NIST's patent, licensing and information dissemination policies and procedures and how to utilize these policies and procedures to advance their research and fulfill NIST's mission. The FY 2009 technology transfer results, as compared to those of FY 2008, demonstrate that improvements to NIST's policies and procedures are producing improved results in invention disclosures and patent applications filed.

NIST has an established Patent Review Committee (PRC) which asses new technologies developed by NIST employees and provides recommendations to Operating Unit Directors as to whether or not seeking patent protection is appropriate for each new technology. The PRC meets monthly and consists of one member from each of the scientific Operating Units, one member from Technology Services, and one member from the Office of the Chief Counsel for NIST.

● Small Business Innovation Research (SBIR)
NIST has pioneered a new methodology for US small businesses to spin-off commercially-viable technologies emerging from its research. Through the use of its SBIR Program funds, NIST creates incentives for small U.S. companies to continue research and development on NIST technologies with the goal of transitioning NIST intramural research into practical application, market insertion and ultimate growth of small businesses. The use of the SBIR program to improve Federal technology transfer is a novel approach to merging these two complementary infrastructures, thereby leveraging the advantages of each program.

To date, NIST has made a total of 27 SBIR-TT project awards to small U.S. companies aimed at improving and commercializing NIST developed technologies. The first implementation of the SBIR-TT model was a pilot launch in 2008 which resulted in 11 phase 1 projects, one commercialization license, and two research licenses. The following year, 9 of the 11 prior-year phase 1 projects were awarded phase 2 contracts. Further, 16 new phase 1 projects were initiated which included 9 research licenses and one additional commercialization license. NIST anticipates that, depending upon funding availability, roughly half of new NIST SBIR awards will be dedicated to SBIR-TT projects.

Other Federal agencies with SBIR programs have expressed interest in the preliminary results of NIST's new SBIR-TT approach as a potential tool that they may be able to adopt within their own agencies. The relatively small size of NIST, as compared to most other agencies, has made it a convenient test bed for trying this new approach. The adoption of this new approach by other agencies will require them to coordinate their functional units with systematic procedures for identifying commercially-viable intramural technologies and finding potential awardees capable of advancing commercialization.

● Standard Reference Materials
Standard Reference Materials (SRMs) are one definitive source of measurement traceability in the United States. Measurements using SRMs can be traced to a common, recognized set of basic standards that provide the basis for measurement compatibility among different laboratories. As economic exchange has become more global, customers throughout the world increasingly use SRMs to ensure measurement quality and conformance to process requirements that address both national and international needs. 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 1,283 different types — illustrates the diversity of measurements supported by NIST. 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 economic benefits 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.

Recently, NIST redefined how it counts individual calibration tests. The change in the definition and the increased activity relating to military test equipment has resulted in an annual level of between 18,000 and 26,000 calibration tests. The number of calibrations in individual years fluctuate due to multiyear calibration cycles, shifts in emphasis among specific calibration services that have different numbers of tests for each service item (especially in FY2009) and the overall health of the U.S. economy. NIST's approach for calibration services is driven by the need and demand from its major industry and government customers. NIST is pursuing three major 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;
(3) Accrediting primary and secondary calibration laboratories to meet ongoing industry needs.

The National Voluntary Laboratory Accreditation Program (NVLAP) is a voluntary, fee-supported program to accredit laboratories that are found competent to perform specific tests or calibrations, or types of tests or calibrations. In FY 2008, NVLAP accepted 9 new calibration laboratories into the program—bringing the total to 80—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 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 from measurements done at NIST laboratories, which are then assessed for reliability and evaluated to select the most reliable values. NIST's 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 2008, a major upgrade was made to the widely used NIST/EPA/NIH Mass Spectral Library. Another major innovation in FY 2008 was the addition of three online data products available for a fee: NIST Web Thermo Tables Professional Edition, NIST Web Thermo Tables Lite Edition, and XPS Version 4.0. These new data products enabled NIST to discontinue several older PC based products. At the end of FY 2009, there were 120 SRDs available, 71 of which were online systems available free of charge.

● Software Tools
NIST provides a wide variety of application software programs and testing tools to U.S. industry, academia and other interested users. NIST develops standards, conformance tests, tools, and methods to evaluate the quality of software and the software's conformation to standards. Details on available application software programs developed at NIST can be found at http://www.nist.gov/public_affairs/software.htm.

● Technical Publications
Technical publications are one of the major mechanisms NIST uses to disseminate the results of its research to support the Nation's technical infrastructure, measurements and standards—vital components of leading-edge research and innovation—to industry, academia, and other agencies. NIST staff author over 1,100 publications in peer-reviewed journals each year.

● Collaborative Research, Guest Researchers, and Facilities Users
Cooperative research and development between Federal laboratories, academia and outside partners is an effective means for technology transfer. Beyond the improved know-how and new technologies that result, these joint efforts often create a mutually advantageous leveraging of the collaborators' resources and technical capabilities and provide mechanisms for collaborators to gain new technical competencies and acquire new skills.

Each year, thousands 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 who collaborate with NIST staff on research and development projects of mutual interest and to transfer to the researchers NIST-developed techniques, procedures, and know-how. NIST also sponsors several formal collaboration programs with universities. These programs include: JILA (formerly known as the Joint Institute for Laboratory Astrophysics), 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, a 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, a collaboration among 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, a collaboration between NIST and the University of Maryland that focuses on quantum phenomena and their potential applications.

Another mechanism for establishing joint relationships is the CRADA, an agreement between a Federal laboratory and one or more partners to collaborate on defined R&D projects. The legal authority for CRADAs was created by the Federal Technology Transfer Act of 1986 with the aim to encourage Federal laboratories to participate in R&D partnerships to advance promising new technologies toward commercialization.

● Conferences, Workshops, and Inquiries
Among the most important mechanisms for technology dissemination are communication, education, and interaction among researchers, developers and users of technology. To that end,

NIST hosts numerous conferences, workshops, and other meetings each year to facilitate the transfer of technology. During FY 2008, NIST held 83 conferences with about 8,326 attendees. Additionally, NIST staff was made available to answer more than 6,564 e-mail, telephone, and mail inquiries from the public, including inquiries from many researchers, requesting information and details about NIST technical developments and research results.

● Participation in Documentary Standards Committees

Another means by which NIST transfers technology is through active participation in documentary standards developing organizations, which develop consensus standards on a host of technologies. NIST participation enables its scientists and engineers to bring NIST technology and know-how directly into standards setting bodies. NIST provides expertise to these organizations that, for example, could involve test methods and procedures for protecting health, safety, and/or the environment or specifications for performance or interoperability with the aim of improving the competitiveness of U.S. companies in the world market. During FY 2009, 419 NIST staff members participated on 1019 standards committees representing 111 standards-developing organizations. NIST staff held 1,415 memberships on these committees, including 415 in ASTM International (formerly the American Society for Testing and Materials), 61 in the American National Standards Institute (ANSI), 88 in IEEE (formerly the Institute of Electrical and Electronics Engineers, Inc.), and 105 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 number of formal training programs. In FY 2009, 665 attendees attended 41 NIST training classes held by 9 NIST divisions. Numbers in support of training were down from the previous two years due to staff resources being dedicated to other priority areas thus minimizing resources available to support basic measurement services and training efforts. Special metrology workshops were held in collaboration with professional associations and regional metrology organizations including the National Conference of Standards Laboratories, the International Measurement Science Conference, and the InterAmerican Metrology System.

● SURF, SHIP, and Summer Institute for Middle School Science Teachers Programs

NIST has been recognized as a vital contributor to the nations' scientific and engineering fields for innovation and competitiveness. As part of its mission and to help create a long-term and well-qualified workforce for standards and measurement research, NIST has several education outreach programs and partnerships that enrich basic research programs. Examples of these programs include the Summer Undergraduate Research Fellowship (SURF) program, the Summer High School Internship (SHIP) program and the NIST Summer Institute for Middle School Science Teachers.

The SURF program is a partnership, supported by NIST, NSF and participating colleges/universities, that provides opportunities for undergraduate students to engage in world-class research at NIST's unique research facilities. The program, operating since 1993, provides an opportunity to encourage and excite the interest of our nations' next generation of scientists and engineers. SURF encompasses all nine technical laboratories at NIST, and a separate program is operated in Boulder. From 1993 through the current year, there have been a total of

1372 participants in the SURF program. The program provides students majoring in science, mathematics and engineering with a clear view challenges and rewards of technical research at NIST, combining the academic components that include publication of original work with real world applications that students would find in an industrial setting. For the summer of 2009, the NIST Gaithersburg campus hosted 151 students in the program from 71 universities and colleges, and at the NIST Boulder campus, there were 14 students representing 12 different universities and colleges.

In 2009, NIST launched the SHIP program designed for students who will have finished their junior or senior year of high school by the start of the program and are interested in scientific research. This competitive volunteer program gives students the opportunity to participate in cutting-edge research at NIST, and work closely with NIST scientists and engineers on a specific research problem. Students are assigned a NIST Research Mentor who oversees the internship.

Among the training sessions offered in FY 2009 was the Summer Institute for Middle School Science Teachers (SIMSST). The program began as a partnership with Maryland's Montgomery County Public School system in 2007. This is a two-week long workshop held each summer, designed to support middle school science teachers through a combination of hands-on activities, lectures, tours, and visits with scientists in their laboratories. The topics are planned to coordinate with the middle school curriculum, and the teachers are provided with resources and instructional tools for teaching math and science, with an emphasis on the measurement science used at NIST. A selection of the cutting-edge research at NIST is presented and teachers are guided through hands-on activities designed to be used in classroom-based learning modules. In addition to ideas and selected activities to incorporate into lesson plans, teaching tools are provided to allow the teachers to demonstrate to their students some of the selected activities. This includes a LabQuest instrument that each participating teacher can bring take to their school with the supplemental probes. This year's Summer Institute had 16 participants. These were twelve from Montgomery County Public Schools, two from Howard County Public Schools, one from Prince Georges County Public School and one from Carroll County Public Schools.

● 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 the 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 news releases, websites, and contacts with the media, NIST publishes *Tech Beat*, a biweekly plain language newsletter of recent research results.

Performance in FY 2009: 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, patenting, and licensing. In addition, data are also provided for some of the other technology transfer mechanisms utilized by the NIST laboratories such as: Standard Reference Materials, Standard Reference Data, technical publications produced, calibration tests, and guest researcher collaborations. We have also provided a selection of

examples of successfully transferred NIST technologies, including some that are well down the road of commercialization.

■ Collaborative Relationships for Research and Development

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **CRADAs**, total active in the fiscal year [1]	1,618	2,488	2,488	2,343	2,343
- New, executed in the fiscal year	1,579	1,646	1,585	1,575	1,492
▪ Traditional CRADAs, [2] total active in the fiscal year	65	135	140	121	65[7]
- New, executed in the FY	26	74	20	12	19
▪ Non-traditional CRADAs, [3] total active in the fiscal year	1,553	2,353	2,348	2,224	2,284
- New, executed in the fiscal year	1,553	1,572	1,565	1,565	1,473
● **Other types of collaborative R&D relationships**					
▪ Facility Use Agreements, total in effect, end of the fiscal year [4] (NCNR, CNST)	588	639	717[5]	635	760
- New, executed in the fiscal year	280	283	397[5]	399	409
▪ Guest scientists and engineers during the fiscal year [6]	2,115	2,114	2,672	2,816	2,828

CRADA = Cooperative Research and Development Agreement.
(1) "Active" means agreements in force at any time during the fiscal year. "Total active" is comprehensive of all agreements executed under CRADA authority (15 U.S.C. 3710a).
(2) CRADAs involving collaborative research and development by a Federal laboratory and non-Federal partners.
(3) CRADAs used for special purposes, such as laboratory accreditation, materials 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) Reflects correction of data from FY 2007 Report.
(6) "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.
(7) The decrease in CRADAs is attributable to the successful conclusion of multi-CRADA Consortiums.

■ Invention Disclosure and Patenting

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● New inventions disclosed in the fiscal year [1]	19	10	29	40	36
● Patent applications filed in the fiscal year [2]	11	4	6	18	18
● Patents issued in the fiscal year	9	6	3	1	7
● Active patents, end of the fiscal year	154	132	129	131	123

(1) Inventions arising at NIST laboratories.
(2) 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. (A PCT application is an application filed under the Patent Cooperation Treaty. This treaty provides a unified procedure for filing patent applications in each of its contracting States.)

■ Licensing

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.

Profile of Active Licenses

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **All licenses**, number total active in the fiscal year [1]	26	24	30	23	33
▫ New, executed in the fiscal year	5	3	5	2	11
▪ **Invention licenses**, total active in the fiscal year	26	24	30	23	33
▫ New, executed in the fiscal year	5	3	5	2	11
- Patent licenses, [2] total active in the fiscal year	26	24	30	23	33
▫ New, executed in the fiscal year	5	3	5	2	11
- Material transfer licenses (inventions), total active	0	0	0	0	0
▫ New, executed in the fiscal year	0	0	0	0	0
- Other invention licenses, total active in the fiscal year	0	0	0	0	0
▫ New, executed in the fiscal year	0	0	0	0	0
▪ **Other IP licenses**, total active in the fiscal year	0	0	0	0	0
▫ New, executed in the fiscal year	0	0	0	0	0
- Copyright licenses (fee-bearing)	0	0	0	0	0
▫ New, executed in the fiscal year	0	0	0	0	0
- Material transfer licenses (non-inventions), total active	0	0	0	0	0
▫ New, executed in the fiscal year	0	0	0	0	0

(1) "Active" means in force at any time during the fiscal year.
(2) Includes patent applications that are licensed.

Licensing Management

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **License negotiation time,** [1] licenses granted in the fiscal year					
▪ **Invention licenses** (Patent licenses) [2]					
▫ Average, months	1.0	6.0	2.0	10.5 [3]	4.8
▫ Minimum	1.0	1.0	1.0	3.0	3
▫ Maximum	1.0	13.0	3.0	18.0 [3]	7
● **Licenses terminated for cause,** number in the fiscal year					
▪ **Invention licenses** (Patent licenses) [2]	1	0	0	0	0

(1) Date of license application to date of license execution. (Date of license application is the date the laboratory formally acknowledges the written request for a license from a prospective licensee and agrees to enter into negotiations.)
(2) Patent licenses include patent applications that are licensed.
(3) These numbers reflect an increase in income-bearing licenses, which take longer to negotiate than royalty-free research licenses.

Income from licensing comes from various sources: license issue fees, earned royalties, minimum annual royalties, paid-up license fees, reimbursement for full-cost recovery of goods and services provided by the laboratory to the licensee, including patent costs.

Characteristics of Licenses Bearing Income

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **All income bearing licenses,** [1] total number	17	18	21	21	22
▫ Exclusive	11	16	16	14	15
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	6	2	5	7	7
▪ **Invention licenses** (Patent licenses), [1] [2] total distributed, income bearing	17	18	21	21	22
▫ Exclusive	11	16	16	14	15
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	6	2	5	7	7
▪ **Other IP licenses**, income bearing	0	0	0	0	0
● **All royalty bearing licenses,** [3] total number	17	18	21	21	22
▪ Invention licenses, royalty bearing	17	18	21	21	22
- Patent licenses,[2] royalty bearing	17	18	21	21	22
▪ **Other IP licenses,** royalty bearing	0	0	0	0	0

(1) Detailed statistics are required under the Technology Transfer Commercialization Act of 2000 (P.L. 106-404) [15 U.S.C. Section 3710 (f)].
(2) Patent licenses include patent applications which are licensed.
(3) Royalties are only one component of total license income.

Income from Licenses

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **Total income,** all licenses active in FY [1]	$123,348	$156,793	$195,347	$223,640	$197,445
▪ **Invention licenses** (patent licenses) [2]	$123,348	$156,793	$195,347	$223,640	$197,445
▪ **Other IP licenses,** total active in the fiscal	0	0	0	0	0
● **Total Earned Royalty Income** (ERI) [3][4]	$123,348	$156,793	$195,347	$223,640	$197,445
▫ Median ERI	$2,500	$5,000	$15,000	$20,000	$15,625
▫ Minimum ERI	$640	$640	$1,280	$640	$320
▫ Maximum ERI	$45,000	$85,403	$169,067	$100,000	$100,000
▫ ERI from top 1% of licenses	dw	dw	dw	dw	dw
▫ ERI from top 5% of licenses	dw	dw	dw	dw	dw
▫ ERI from top 20% of licenses	dw	dw	dw	dw	dw
▪ **Invention licenses** (Patent licenses) [2] [4]	$123,348	$156,793	$195,347	$223,640	$197,445
▫ Median ERI	$2,500	$5,000	$15,000	$20,000	$15,625
▫ Minimum ERI	$640	$640	$1,280	$640	$320
▫ Maximum ERI	$45,000	$85,403	$169,067	$100,000	$100,000
▫ ERI from top 1% of licenses	dw	dw	dw	dw	dw
▫ ERI from top 5% of licenses	dw	dw	dw	dw	dw
▫ ERI from top 20% of licenses	dw	dw	dw	dw	dw
▪ **Other IP licenses,** total active in the fiscal	$0	$0	$0	$0	dw

"n/a" means that the data is not available from the agency at time of this report.
"dw" means data withheld to protect proprietary information.

(1) Total income includes license issue fees, earned royalties, minimum annual royalties, paid-up license fees, reimbursement for full-cost recovery of goods and services provided by the laboratory to the licensee including patent costs and Standard Reference Data.
(2) Patent license tally includes patent applications which are licensed.
(3) "Earned royalty" is a 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.
(4) Detailed statistics are required under the Technology Transfer Commercialization Act of 2000 (P.L. 106-404) [15 U.S.C. Section 3710 (f)].

Disposition of Invention License Income

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **Income distributed** [1] ▪ **Invention licenses,** (Patent licenses), [2] total distributed	$123,348	$156,793	$195,347	$223,640	$197,445
- To inventor(s)	$48,148 (39%)	$47,536 (30%)	$65,100 (33%)	$75,140 (33%)	$66,757 (34%)
- To other [3]	$75,199 (61%)	$109,257 (70%)	$130,247 (67%)	$148,500 (66%)	$130,688 (66%)

(1) Income includes royalties and other payments received during the fiscal year.
(2) Patent licenses include patent applications which are licensed.
(3) NIST only in FY 2001-2004. In FY 2005, $1500 went to the National Institutes of Health and the rest went to NIST.

Other Performance Measures Deemed Important by the Agency

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
Standard Reference Materials (SRMs) available [1]	1,246	1,302	1,285	1,282	1,283
Standard Reference Materials (SRMs) units sold [2]	32,163	31,195	32,614	33,373	29,769
Standard Reference Data (SRD) titles available [3]	110	113	109	102	120
Number of calibration tests performed [4]	12,849	13,127	27,489*	25,944	18, 609
Technical publications in peer-reviewed journals[5]	1,148	1,163	1,272	1,271	1,463

* The number of calibration tests performed in FY 2007 was significantly higher than the number of tests performed in FY 2005 and FY 2006 due principally to a surge in calibration testing for the military and its contractors.

(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 Environmental Protection Agency (EPA) regulations, environmental activities, an increase 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 40% are available for sale, and 60% are free online systems. Over time, a larger percentage of SRDs will be distributed via the Internet. New growth in online systems was anticipated for FY 2008-09 with the release of fee-based titles for the Internet.
(4) Calibration tests performed by the NIST laboratories.
(5) Annual number of NIST's technical publications appearing in influential scientific peer-reviewed journals.

Other Performance Measures Deemed Important by the Agency

■ Some of the Prestigious Awards for NIST's Scientific Technology received in FY 2009:

● Sigma Xi's 2009 William Procter Prize for Scientific Achievement
Physicist Deborah S. Jin, a Fellow of NIST and JILA (a joint institute of NIST and the University of Colorado at Boulder), received Sigma Xi's 2009 William Procter Prize for Scientific Achievement. Sigma Xi noted that "Her research has been described as the crucial first step in developing superconductors that work at room temperature, which could lead to faster computers and other advances."

● 2009 R&D 100 award from R&D Magazine
Commercial process-design software that incorporates NIST's thermophysical and thermochemical property data sets received a 2009 R&D 100 award from R&D Magazine. The annual award recognizes the 100 most technologically significant products introduced during the past year. The award recognizes Aspen Plus® 2006.5 with NIST ThermoData Engine (TDE), a process simulator that provides new tools to significantly increase the number and variety of chemical components that may be considered by the process design engineer, while dramatically reducing the time required for compilation and critical evaluation of component properties. The product is marketed by Aspen Technology Inc., and is used in a range of industries.

● 2009 European Frequency and Time Award
Jun Ye, a NIST Fellow working at JILA, received the 2009 European Frequency and Time Award in April during the joint European Frequency and Time Forum and IEEE International Frequency Control Symposium held in France. Ye was honored for his pioneering work in establishing a neutral atom optical lattice clock, narrow linewidth lasers, femtosecond spectroscopy, and phase-coherent transmission of frequencies via optical fibers.

● 2009 William F. Meggers Award
Leo Hollberg, a physicist who recently retired from NIST Boulder, received the 2009 William F. Meggers Award from the Optical Society of America (OSA). The award recognizes outstanding work in spectroscopy. Hollberg was cited for his seminal contributions to the development of diode lasers as powerful spectroscopic tools, development of femtosecond frequency combs, and demonstration of unique quantum effects in the interaction between light and atoms.

Sample Results from NIST Technology Transfer Activities

● Mitigating the Effects of Wind on High-Rise Fires
Together with the Fire Protection Research Foundation, the Fire Department of New York City (FDNY) and the Polytechnic Institute of New York University, researchers at NIST recently published two reports detailing the detrimental effects of wind on fires in high-rise buildings. The research describes how wind impacts the spread of fire through a structure and examines the capabilities of positive pressure ventilation, wind-control devices, and externally applied water to mitigate hazards. The research results are available for firefighter training, and will lead to improved safety for civilians and firefighters.

Based on NIST's recommendations, the FDNY has amended their standard operating procedures for apartment dwellings, including how they vent the building, and they have purchased positive pressure ventilation fans, wind control devices and floor below nozzles and deployed them throughout the city. The FDNY has also produced new training materials using NIST data and instructional videos to teach their 11,000 members how to employ these new technologies and techniques. Firefighters around the world have also expressed interest in learning more about using wind control and ventilation and other firefighting technologies developed or recommended by NIST.

● NIST Teams with Carl Zeiss Inc. on Nanomanufacturing
Researchers at the NIST and at Carl Zeiss, Inc. are improving nanoscale measurement accuracy to help manufacturing industries. Because the economic value of smaller dimensions is measured in billions of dollars per nanometer, manufacturers have a huge incentive to push measurement technologies to the smallest limits.

Via a cooperative research and development agreement, NIST and Zeiss researchers tested Orion, the first commercial helium ion microscope, at NIST's Advanced Measurement Laboratory (AML). "What we are learning goes directly back to the manufacturers to improve their products, which allows NIST and industry to obtain the most precise measurements possible," explains Michael Postek, chief of NIST's Precision Engineering Division. "We are transferring NIST technology and sharing our research with the semiconductor industry trade organization, SEMATECH." Zeiss recently unveiled its new Orion Plus, incorporating many of NIST's design suggestions including a better helium cooling system for improved imaging.

● Femtomolar Optical Tweezers
NIST has licensed a patented "optical tweezers" technique for detecting and measuring very small concentrations of a biological substance—such as a virus on a surface. NIST has issued a non-exclusive license for the technology to Haemonetics, a global health care company that provides blood management technologies for hospitals and blood and plasma collection agencies.

Following up on earlier work in optical tweezers in the industrial and academic research communities in the 1970s, the licensed technology was patented (patent #5,620,857), as a result of research conducted under the NIST BioSensor Consortium by inventors Howard Weetall, Kristian Helmerson, and guest researcher Rani Kishore.

● Measuring the Resistance to Fracture

Researchers at NIST have developed a method to measure the toughness—the resistance to fracture—of the thin insulating films that play a critical role in high-performance integrated circuits (ICs). The new technique could help improve the reliability and manufacturability of ICs and, better yet, it's one that state-of-the-art microelectronics manufacturers can use with equipment they already own. To date, there has been no accurate method to measure the fracture resistance of such films, which makes it difficult to design improved dielectrics. NIST researchers believe they have found an answer to the measurement problem in a new adaptation of a materials test technique called nanoindentation.

Researchers have known how to measure elasticity and plasticity—the forces needed to bend a material either temporarily or permanently—of materials at very small scales with nanoindenters. But *toughness,* the force needed to actually break the material, has been more problematic. Using NIST's methodology, device manufacturers will be able to eliminate some candidate films from consideration without further expensive device testing. The measurement technique and model were published in a two-part series in the *Journal of Materials Research*.

● Improving Software Tools that Analyze Software

Static analyzers try to find weaknesses in other software programs that could be triggered accidentally or exploited by hackers. A new report by NIST documents the Static Analysis Tool Exposition (SATE), an exercise by NIST and static analyzer vendors to improve the performance of these tools. The report is the culmination of a lengthy effort to host and then digest the results of SATE, begun in February 2008 to help toolmakers assess their products' ability to find security defects in other software. Eight tool developers, along with a ninth team of professional human reviewers, participated in SATE, which provided a non-competitive environment for the vendors to compare their program analysis techniques for the benefit of the entire group.

The importance of software assurance tools has increased as programs grow longer, more sophisticated, and increasingly are required to interact with other programs over computer networks. The number and subtlety of attacks from hackers has also increased. The SATE report is available online at http://samate.nist.gov/docs/NIST_Special_Publication_500-279.pdf.

CHAPTER 3

National Oceanic and Atmospheric Administration

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 related to climate change, limited 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. About one-third of the U.S. economy (approximately $3 trillion) is weather sensitive. The agriculture, energy, construction, health, travel, and transportation industries are almost entirely weather dependent. Weather data and forecasts play a critical role in these major economic sectors of our economy-- and are transferred to the 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. Weather data have been used for deciding such things as automobile fuel delivery system design, the best time to market umbrellas, and even for when the conditions would be optimum 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 laboratories is primarily aimed at assisting NOAA's operational components. Recent examples demonstrating the direction of NOAA's research are weather forecasting, solar emission forecasting, estimating fish stocks, predicting water resources, warning of tsunamis, and charting ocean bottom topography. Research results 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, fishery statistics, 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 Cooperative Research and Development Agreements (CRADAs) -- with industry to benefit the competitiveness of U.S. companies.

In FY 2009, 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 also 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 example, 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 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 an international visiting scientist program. In addition, environmental data are 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.

Performance in FY 2009: Activities and Achievements

■ Collaborative Relationships for Research & Development

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **CRADAs,** total active in the fiscal year [1]	8	6	5	4	5
- New, executed in the fiscal year	0	0	0	1	1
▪ Traditional CRADAs,[2] total active in the fiscal year	8	6	5	4	5
- New, executed in the fiscal year	0	0	0	0	0
▪ Non-traditional CRADAs,[3] total active in the fiscal year	0	0	0	0	0
- New, executed in the fiscal year	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" means force at any time during the fiscal year. "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 2005	FY 2006	FY 2007[3]	FY 2008	FY 2009
● New inventions disclosed in the fiscal year [1]	1	4	3	0	4
● Patent applications filed in the fiscal year [2]	1	0	2	3	1
● Patents issued in the fiscal year	1	0	0	1	0

(1) Inventions arising at the Federal laboratory.
(2) 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.
(3) Correction made to FY 2007 on number of patent applications and patents issued. The patent for the DART (Deep-ocean Assessment and Reporting of Tsunamis) system was expected to be issued in September 2007 but was not issued until October 30, 2007.

■ Licensing

Profile of Active Licenses

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **All licenses**, number total active in the FY [1]	4	5	6	6	7
▫ New, executed in the FY	0	1	3	0	1*
▪ **Invention licenses**, total active in the FY	4	5	6	6	7
▫ New, executed in the FY	0	1	3	0	0
- Patent licenses,[2] total active in FY	4	5	6	6	7
▫ New, executed in the FY	0	1	3	0	0
- 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)					
▫ 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" means in force at any time during the FY.

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

* One-Time License only with one-time flat fee royalty

Licensing Management

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **License negotiation time**,(1) licenses granted in the FY					
▪ **Invention licenses** ▫ Average, months ▫ Minimum ▫ Maximum	*	7.0	5.0 6.0 7.0	*	7.0
- Patent licenses (2) ▫ Average, months ▫ Minimum ▫ Maximum	*	7.0	5.0 6.0 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, FY 2005, 2008.

(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 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **All income bearing licenses**, total number	4	5	4	4	5
▫ Exclusive	1	1	0	0	0
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	3	4	4	4	5
▪ **Invention licenses**, income bearing	4	5	4	4	5
▫ Exclusive	1	1	0	0	0
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	3	4	4	4	5
- Patent licenses,(1) income bearing	4	5	4	4	5
▫ Exclusive	1	1	0	0	0
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	3	4	4	4	5
▪ **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	4	5	4	4	5
▪ **Invention licenses**, royalty bearing	4	5	4	4	5
- Patent licenses,(1) royalty bearing	4	5	4	4	5
▪ **Other IP licenses**, royalty bearing	0	0	0	0	0
- Copyright licenses (fee bearing)	4	5	4	4	5

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 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **Total income**, all licenses active in the FY [1]	$16,100	$13,100	$22,000	$69,007	$138,444[4]
▪ **Invention licenses**	$16,100	$13,100	$22,000	$69,007	$138,444
- Patent licenses [2]	$16,100	$13,100	$22,000	$69,007	$138,444
▪ **Other IP licenses**, total active in the FY	0	0			
- Copyright licenses					
● **Total Earned Royalty Income** (ERI) [3]	$16,100	$13,100	$22,000	$69,007	$138,444
▫ Median ERI	$1,000	$1,000	$4,000	$9,007	$19,000
▫ Minimum ERI	$100	$100	$1,000	$1,000	$1,000
▫ Maximum ERI	$9,000	$5,000	$9,000	$25,000	$75,000
▫ ERI from top 1% of licenses	$9,000	$5,000	$9,000	$25,000	$75,000
▫ ERI from top 5% of licenses	$9,000	$5,000	$9,000	$25,000	$75,000
▫ ERI from top 20% of licenses	$9,000	$5,000	$9,000	$25,000	$75,000
▪ **Invention licenses**	$16,100	$13,100	$22,000	$69,007	$138,444
▫ Median ERI	$1,000	$1,000	$4,000	$9,007	$19,000
▫ Minimum ERI	$100	$100	$1,000	$1,000	$1,000
▫ Maximum ERI	$9,000	$5,000	$9,000	$25,000	$75,000
▫ ERI from top 1% of licenses	$9,000	$5,000	$9,000	$25,000	$75,000
▫ ERI from top 5% of licenses	$9,000	$5,000	$9,000	$25,000	$75,000
▫ ERI from top 20% of licenses	$9,000	$5,000	$9,000	$25,000	$75,000
- Patent licenses [2]	$16,100	$13,100	$22,000	$69,007	$138,444
▫ Median ERI	$1,000	$1,000	$4,000	$9,007	$19,000
▫ Minimum ERI	$100	$100	$1,000	$1,000	$1,000
▫ Maximum ERI	$9,000	$5,000	$9,000	$25,000	$75,000
▫ ERI from top 1% of licenses	$9,000	$5,000	$9,000	$25,000	$75,000
▫ ERI from top 5% of licenses	$9,000	$5,000	$9,000	$25,000	$75,000
▫ ERI from top 20% of licenses	$9,000	$5,000	$9,000	$25,000	$75,000
▪ **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					
▫ 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 & 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.

(4) Increase is due to a license with Walt Disney for NOAA's Science on a Sphere for a one-time royalty of $75,000.

Disposition of License Income

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● **Income distributed** [1]					
▪ **Invention licenses**, total distributed	$16,100	$13,100	$22,000	$69,007	$138,444
- To inventor(s)	$8,400 (52%)	$7,500 (57%)	$12,200 (55%)	$21,802 (32%)	$45,153 (33%)
- To other	$7,700 (48%)	$5,600 (43%)	$9,800 (45%)	$46,205 (68%)	$93,291 (67%)
- Patent licenses, [2] total distributed	$16,100	$13,100	$22,000	$69,007	$138,444
- To inventor(s)	$8,400 (52%)	$7,500 (57%)	$12,200 (55%)	$21,802 (32%)	$45,153 (33%)
-To other	$7,700 (48%)	$5,600 (43%)	$9,800 (45%)	$46,205 (68%)	$93,291 (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.

■Other Performance Measures Deemed Important by the Agency

	FY 2005	FY 2006	FY 2007*	FY 2008*	FY 2009
Journal articles published	397	444	833	774	631
Technical reports published	226	148	265	201	134

*Publication counts have been recently updated by the NOAA Laboratories for FY 2007 and FY 2008.

GREAT LAKES ENVIRONMENTAL RESEARCH LABORATORY	FY 2007	FY 2008	FY 2009
Website hits (HTML pages)	2,244,420	3,086,605	2,790,351
Website downloads (PDF pages)—brochures, research papers, technical memos, etc.	65,740	110,880	93,400

*Update made for FY2007 and FY 2008 on number of articles published and reports published.

	FY 2009
NOAA Inventors on Patents filed "by Others"	**1***

*NOAA's PMEL Scientist on Cortland Patent

Other Performance Measures Deemed Important by the Agency

■ Prestigious Awards for NOAA's Scientific Technology received in FY 2009

● NOAA Technology Transfer Award
Tracy Hansen, Thomas LeFebvre, Mark Mathewson, Mike Romberg – In recognition of the development of the Graphical Forecast Editor, which has proven its worth beyond government rank and is being used by private industry to support forecast operations.

● NOAA Gold Medal Award
Roland Draxler – In recognition "for being the driving force behind the initial development and continued improvement of the Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) atmospheric and dispersion modeling system. He led the successful transfer of the HYSPLIT from research to operations within NOAA, where it supports protection of the public from hazards such as toxic chemicals, wildfire smoke, radioactive plumes, and volcanic ash. He has also led collaborations, technology transfer, and training that have enabled other agencies and countries to use HYSPLIT to protect life, property, and the environment."

Sample Results from NOAA Technology Transfer

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

● Tsunami "Train-the-Trainer" Training
The Washington State Train-the-Trainer program aims to develop an educational curriculum to train qualified Tsunami Public Education Instructors. The Train-the-Trainer program is a joint effort of the NOAA Center for Tsunami Research (NCTR) and the Washington state Emergency Management Division (WA EMD). On 9 June 2009, WA EMD hosted a Pilot Train-the-Trainer Workshop. The workshop objective was to conduct a Pilot Project to initiate, test, and refine a curriculum for a Trainer program that will be developed and taught by the NCTR in collaboration with WA EMD to graduate qualified Tsunami Public Education Instructors as identified by WA EMD. This objective is a critical component essential to the National Tsunami Hazard Mitigation Program (NTHMP) Educational Plan. The Workshop was a joint effort of the WA EMD and the NCTR. A total of 31 participants from various coastal Washington jurisdictions took part in the Workshop. Attendees included personnel from county and community organizations such as Emergency Management and Community Emergency Response Team (CERT)

● HYSPLIT (Hybrid Single-Particle Lagrangian Integrated Trajectory) Model
The HYSPLIT model is the newest version of a complete system for computing simple air parcel trajectories to complex dispersion and deposition simulations. The model is widely used by government, commercial, and university personnel, both in the United States and from many foreign nations to provide plume simulations in support of emergency response operations, as part of research efforts addressing source-receptor questions, and by glider pilots and balloonists for recreational purposes. Registered users of HYSPLIT have increased dramatically over the

past year. User statistics include: Commercial users: 244 Government (federal, state, and foreign) 442 University (US and foreign) 1383, Military 58, Non-Profits 57, private pilots (balloonists, glider pilots) 88 The model can be run interactively on the Web through the Air Resources Laboratory's READY system on the ARL web site or the code executable and meteorological data can be downloaded to a Windows PC. The dispersion of a pollutant is calculated by assuming either puff or particle dispersion. In the puff model, puffs expand until they exceed the size of the meteorological grid cell (either horizontally or vertically) and then split into several new puffs, each with its share of the pollutant mass. In the particle model, a fixed number of initial particles are advected about the model domain by the mean wind field and a turbulent component. The model's default configuration assumes a puff distribution in the horizontal and particle dispersion in the vertical direction. In this way, the greater accuracy of the vertical dispersion parameterization of the particle model is combined with the advantage of having an ever expanding number of particles represent the pollutant distribution.

● **Graphical Forecast Editor**

The Graphical Forecast Editor (GFE) is used operationally by NOAA's National Weather Service (NWS) forecasters to create and maintain sets of sensible weather elements (temperature, wind, precipitation, etc.) in gridded form over their respective forecast areas. These grids are the basis for generation of most routine text forecasts, long-fused warnings, and the increasingly popular point-and-click graphical forecasts available on the Web. They are also combined into a National Digital Forecast Database, available to the public and private industry to support weather-related decision making.

The sound fundamental design of GFE also makes it practical to adapt the system for international application. The NOAA team recently has worked with the meteorological agencies of Taiwan and Australia to tailor GFD systems for their forecast environments. Since October 2008 the Australia Bureau of Meteorology's Victorian Region Forecast Centre has used GFE to issue daily weather forecasts of Victoria State, including areas hit hard by wildfires earlier this year. Commenting on their experience transferring this technology they state, "The success of the launch was critically dependent on two things. Firstly, you gave us a terrific system to start with. Its functionality, robustness and excellent design have been so important. Secondly, your help in further developing the GFE to our requirements has been superb. We couldn't have asked for more enthusiastic, responsive and professional support." The meteorological agency in Spain has also recently expressed interest in transferring GFE technology into their forecast operations.

● **Collaboration and Training: Harmful Algal Blooms and Harmful Algal Toxins**

The NOAA's National Centers for Coastal Ocean Science (NCCOS) researchers hosted a visiting researcher from the Republic of Korea's National Fisheries Research and Development Institute during January and February of 2009 to initiate development of a method for detecting the Harmful Algal Bloom organism Psuedo-nitzschia. Species of Psuedo-nitzschia and their associated toxin, domoic acid, have recently been identified near aquaculture sites along the Korean coast and are growing concern to industry and public health officials. Molecular probes targeting Korean species of this organism are being designed and incorporated into a test kit that will enhance monitoring and mitigation efforts.

In April 2009, NCCOS researchers conducted a month-long training course to transfer detection technologies for harmful algal toxins to regulatory officials and scientists from Thailand The training course, sponsored by the United Nations International Atomic Energy Agency and facilitated by NOAA's National Ocean Service's International Program Office, is designed to improve toxin detection methods currently used to regulate and monitor seafood for domestic consumption and export, as well as for research purposes.

CHAPTER 4

National Telecommunications and Information Administration—Institute for Telecommunication Sciences

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.

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. This metric provides a useful working indicator of the number of quality publications released to the public. In 2004, ITS added a measure for participation on standards committees. In 2006, ITS added another metric, the total number of hits on the publications listed on the "ITS Online Documents." This metric more directly provides an indication of ultimate benefit to the public.

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**
  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 2009, 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 constructive communications technologies. More recently, CRADAs in the areas of objective audio and video quality, advanced antennas for wireless systems, remote sensing and global position (GPS) technology have allowed ITS to contribute to the development of new products and services.

- **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 peer-reviewed articles in external scientific journals—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 as unbiased by commercial interests.

In FY 2009, 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.

Performance in FY 2009: Activities and Achievements

■ Collaborative Relationships for Research & Development

	FY 2005	FY 2006	FY 2007	FY 2008 (1)	FY 2009
● **CRADAs,** total active in the fiscal year (1)	278	514	285	41	32
- New, executed in the fiscal year	185	512	280	7	8
▪ Traditional CRADAs,(2) total active in the fiscal year	7	8	9	6	7
- New, executed in the fiscal year	5	6	4	6	7
▪ Non-traditional CRADAs,(3) total active in the fiscal year	273	506	276	35	25
- New, executed in the fiscal year	144	506	276	1	1
● **Other types of collaborative R&D relationships**					
▪ Collaborative standards contributions,(4) total active in FY	11	16	25	25	20
-New, executed in the fiscal year	0	5	9	10	5

CRADA = Cooperative Research and Development Agreement.

(1) In 2008, ITS took down from the Web some of its telecommunication analysis services. These services provided network-based access to research results, models, and databases supporting applications in wireless system design and analysis. As a result, CRADAs between the government and industry, which allowed for improvement to these models, were down significantly. NTIA-ITS is working on a newer geographic information system- (GIS-) based platform for the modeling services, which will be available in future years.

(2) "Active" means in force at any time during the fiscal year. "Total active" includes all agreements executed under CRADA authority (15 USC 3710a).

(3) CRADAs involving collaborative research and development by a Federal laboratory and non-Federal partners.

(4) 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.

(5) ITS works with industry to apply research results to the development of telecommunication performance standards and guidelines. In FY 2009, ITS worked collaboratively with the ITU, the Telecommunications Industry Association, the ATIS, and various Federal public safety groups to interpret and analyze standards and regulations.

■ Invention Disclosure and Patenting

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
● New inventions disclosed in the fiscal year [1]	1	0	0	0	0
● Patent applications filed in the fiscal year [2]	0	1	0	0	0
● Patents issued in the fiscal year	0	1	0	0	0
● Active patents, end of the fiscal year	6	8	7	7	2

(1) New invention disclosed and provisional patent filed.
(2) 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 2005	FY 2006	FY 2007	FY 2008*	FY 2009
● **All licenses,** number total active in the fiscal year [1] [2]	103	82	186	0	0
▫ New, executed in the fiscal year	103	79	179	0	0
▪ **Invention licenses,** total active in the fiscal year	103	82	186	0	0
▫ New, executed in the fiscal year	103	79	179	0	0
- Patent licenses,[3] total active in the fiscal year	3	7	10	0	0
▫ New, executed in the fiscal year	0	4	3	0	0
- Material transfer licenses (inventions), total active	0	0	0	0	0
▫ New, executed in the fiscal year	0	0	0	0	0
- Other invention licenses, [4] total active in the fiscal year	100	75	176	0	0
▫ New, executed in the fiscal year	100	75	176	0	0
▪ **Other IP licenses,** total active in the fiscal year	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.
* This number of licenses for FY2008 and FY 2009 is zero because ITS no longer licenses Video Quality Metric (VQM) technology. Instead, ITS has made this software available via open-source download.
(1) "Active" = legally in force at any time during the fiscal year.
(2) As of FY 2008, VQM software is available for download without a license.
(3) Patent license tally includes patent applications that are licensed.
(4) International copyright licenses (non-fee-bearing) for VQM technology

Licensing Management

	FY 2005	FY 2006	FY 2007	FY 2008*	FY 2009
● **License Negotiation time**,[1] licenses granted in the fiscal year					
▪ **Invention licenses** (Patent licenses) [2]	2.0	1.5	1.0	0	0
▫ Average (or median), months	1.0	1.0	0.5	0	0
▫ Minimum	3.0	2.0	1.5	0	0
▫ Maximum					
● **Licenses terminated for cause,** number in the fiscal year					
▪ **Invention licenses** (Patent licenses) [2]	0	0	0	0	0

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

* This number of licenses for FY 2008 and FY2009 is zero because ITS no longer licenses Video Quality Metric (VQM) technology. Instead, ITS has made this software available via open-source download.

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

(2) Patent licenses include patent applications that are licensed.

Characteristics of Licenses Bearing Income

	FY 2005	FY 2006	FY 2007	FY 2008*	FY 2009
● **All income-bearing licenses,** total number	4	7	10	0	0
▫ Exclusive	0	0	0	0	0
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	4	7	10	0	0
▪ **Invention licenses,** (Patent licenses), [1] income-bearing	4	7	10	0	0
▫ Exclusive	0	0	0	0	0
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	4	7	10	0	0
▪ **Other IP licenses,** income-bearing	0	0	0	0	0
● **All royalty-bearing licenses,** [2] total number	4	7	0	0	0
▪ **Invention licenses,** (Patent licenses) [1] royalty-bearing	4	7	0	0	0
▪ **Other IP licenses,** royalty-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 laboratory to the licensee including patent costs.

* This number of licenses for FY 2008 and FY2009 is zero because ITS no longer licenses Video Quality Metric (VQM) technology. Instead, ITS has made this software available via open-source download.

(1) Patent licenses include patent applications that are licensed.

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

Income from Licenses

	FY 2005	FY 2006	FY 2007	FY 2008*	FY 2009
● **Total income,** all licenses active in the fiscal year [1]	$7,212	$24,500	$7,500	$0	$0
▪ **Invention licenses** (Patent Licenses) [2]	$7,212	$24,500	$7,500	$0	$0
▪ **Other IP licenses,** all active licenses in FY	$0	$0	$0	$0	$0
● **Total Earned Royalty Income** (ERI) [3]	$0	$0	$0	$0	$0
▪ **Invention licenses** (Patent licenses) [2]	$0	$0	$0	$0	$0
▫ Median ERI	$0	$0	$0	$0	$0
▫ Minimum ERI	$0	$0	$0	$0	$0
▫ Maximum ERI	$0	$0	$0	$0	$0
▫ ERI from top 1% of licenses	$0	$0	$0	$0	$0
▫ ERI from top 5% of licenses	$0	$0	$0	$0	$0
▫ ERI from top 20% of licenses					
▪ **Other IP licenses,** total active in the fiscal year	$0	$0	$0	$0	$0

* This number of licenses for FY2008 and FY2009 is zero because ITS no longer licenses Video Quality Metric (VQM) technology. Instead, ITS has made this software available via open-source download.
(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 laboratory to the licensee including patent costs.
(2) Patent licenses include patent applications which are licensed.
(3) "Earned royalty" means 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 2005	FY 2006	FY 2007	FY 2008*	FY 2009
● **Income distributed** [1] ▪ **Invention licenses,** (Patent licenses), [2] total distributed	$7,212	$24,500	$7,500	$0	$0
- To inventor(s)	$3,564 (49%)	$15,750 (64%)	$5,050 (67%)	$0	$0
- To other [3]	$3,648 (51%)	$8,750 (36%)	$2,450 (33%)	$0	$0

Invention licenses are the chief policy interest regarding disposition of income; the content of this table reflects this focus.
* This number of licenses for FY2008 and FY2009 is zero because ITS no longer licenses Video Quality Metric (VQM) technology. Instead, ITS has made this software available via open-source download.
(1) Income includes royalties and other payments received during the fiscal year.
(2) Patent license tally includes patent applications which are licensed.
(3) To ITS/NTIA.

■ **Other Performance Measures Deemed Important by the Agency**

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
Technical publications produced	19	8	3	15	12
Total number of hits on online publications	--	1,116,573	1,426,125	1,526,409	3,020,629

"—"means data not requested from agency in previous years' reports.
See "Technical Publications" above in the first section of this report for additional information on this topic.

Sample Results from ITS 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 (VQM)**

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. 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. In FY 2007, ITS decided to make VQM software commercial licenses available for free. This has increased distribution dramatically. In FY 2008, ITS made VQM software available as an open source download. ITS set up a website to take applications for free VQM downloads.

- **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 three 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 2009, several companies performed antenna, lidar/GPS, and other testing at the Table Mountain turntable facility under a CRADA. Lockheed Martin Coherent Technologies is in its 10th year of performing field-testing and characterization of components, subsystems, and systems for eye-safe coherent laser radar, which has benefited NTIA and the Department of Defense.

SUMMARY

Technology transfer is an essential mission of the Department of Commerce, using our Nation's innovation and investment in science and technology to strengthen our economy and American competitiveness in world markets. This report details the results of technology partnering activities cultivated in the Department of Commerce's Federal laboratories. Federal research is a complex process that provides the opportunity for new ideas and innovations to be successfully marketed to serve citizens. The success stories in this report provide examples of how society benefits from technology transfer activities across the Department of Commerce's Federal laboratories. As knowledge advances and the needs of the economy change, the Department of Commerce will continue to play a role in keeping America in the forefront of innovation and supporting our economy by aiding in the transfer and commercialization of knowledge.