Annual Report on Technology Transfer: Approach and Plans, Fiscal Year 2008 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)

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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) 2008. 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 2004 through FY 2008. 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.

At the Department, research and development (R&D) in numerous areas of contemporary science and technology is conducted at the National Institute of Standards and Technology (NIST), at various laboratory facilities across the National Oceanic and Atmospheric Administration, 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.	▪ In carrying out its mission, NIST works directly with industry partners (and consortia), universities, associations, and other government agencies. ▪ The general focus of NIST's technology transfer activities is the broad dissemination of research results. Accordingly, NIST draws on a diverse group of mechanisms to transfer the knowledge and technologies that result from its laboratory research. ▪ Principal technology transfer mechanisms: o technical publications, o Standard Reference Materials o Standard Reference Data o calibration services o documentary standards o Cooperative Research and Development Agreements (CRADAs) o patents and licenses o software tools o conferences, workshops, and inquiries o 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: o public dissemination o CRADAs o 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: o CRADAs o patents and licenses o telecommunications analysis services o technical publications o development of telecommunications standards

Summary of Technology Transfer Activities Across the Department, FY 2004 – FY 2008

■ Selected Measures Active in Each Fiscal Year

Collaborative Relationships for Research and Development

		FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
● **CRADA**s						
▪ Traditional CRADAs						
	NIST	51	65	135	140	121
	NOAA	9	8	6	5	4
	ITS	7	7	8	9	6
	Department	67	80	149	154	131
▪ Non-traditional CRADAs						
	NIST	1,590	1,553	2,353	2,348	2,224
	ITS	312	273	506	276	35 (1)
	Department	1,902	1,826	2,895	2,510	2,259
● **Other types of collaborative R&D relationships**						
▪ NIST - Facility Use Agreements		590	588	639	717 (2)	635
▪ NIST - Guest scientists and engineers		1,700	2,115	2,114	2,672	2,816
▪ ITS - Collaborative contributions		11	11	16	25	25

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 that allowed for improvement to these models were down 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.

Invention Disclosure and Patenting

		FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
● New inventions disclosed	NIST	23	19	10	29	40
	NOAA	2	1	4	3	0
	ITS	0	1	0	0	0
	Department	25	23	14	32	40
● Patent applications filed	NIST	8	5	4	6	18
	NOAA	0	1	0	2	3
	ITS	0	0	1	0	0
	Department	8	6	5	8 (1)	21
● Patents issued	NIST	10	9	6	3	1
	NOAA	1	1	0	0 (1)	1
	ITS	0	0	1	0	0
	Department	11	10	7	3	2

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

Licensing – Profile of Active Licenses

		FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
● All Department of Commerce licenses		125	133	110	147	29
Patent licenses	NIST	22	26	23	25	23
	NOAA	5	4	5	6	6
	ITS	3	3	7	10	0 (1)
	Department	30	33	35	41	29
Other invention licenses	ITS	95	100	75	106	0

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

Characteristics of Licenses Bearing Income

		FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
● **All income-bearing licenses**	Department	23	25	30	35	25
▪ **Invention licenses**	Department	23	25	30	35	25
- Patent licenses	NIST	15	17	18	21	21
	NOAA	5	4	5	4	4
	ITS	3	4	7	10	0
	Department	23	25	30	35	25
▫ Exclusive, partially exclusive, non-exclusive	NIST	10, 0, 5	11, 0, 6	16, 0, 2	16, 0, 5	14, 0, 7
	NOAA	1, 0, 4	1, 0, 3	1, 0, 4	0, 0, 4	0, 0, 4
	ITS	0, 0, 3	0, 0, 4	0, 0, 7	0, 0, 10	0, 0, 0
	Department	11, 0, 12	12, 0, 13	17, 0, 13	16, 0, 19	14, 0, 11

Income from Licensing

		FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
● **Total income**	Department	$203,289	$146,660	$194,393	$224,847	$292,647
	NIST	$144,828	$123,348	$156,793	$195,347	$223,640
	NOAA	$24,961	$16,100	$13,100	$22,000	$69,007
	ITS	$33,500	$7,212	$24,500	$7,500	$0 (1)

(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.

Agency-Specific Important Mechanisms for Technology and Knowledge Transfer

		FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
Standard Reference Materials (SRMs) available	NIST	1,211	1,246	1,302	1,285	1,282
Standard Reference Materials (SRMs) units sold	NIST	30,490	32,163	31,195	32,614	33,373
Standard Reference Data (SRD) titles available	NIST	95	110	113	109	102
Number of calibration tests performed	NIST	12,503	12,849	13,127	27,489 (1)	25,944 (1)
Technical publications in peer-reviewed journals	NIST	1,070	1,148	1,163	1,272	1,271
Journal articles published	NOAA	419	397	444	584 (2)	515
Technical reports published	NOAA	300	226	148	196 (2)	103
Technical publications produced	ITS	17	19	8	3	15

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

The Department's Performance Metrics for Technology Transfer

This 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/patenting, licensing, and other technology transfer mechanisms. This report also highlights examples of downstream outcomes (e.g., commercially significant technologies) resulting from these Federal laboratory technology transfer activities. The content and format of this year's performance report is consistent with guidelines issued for the annual performance reporting by the Office of Management and Budget in its June 2008 edition of Circular A-11.

Across the Department, technology transfer involves a good deal more than cooperative R&D, patenting, and licensing. These "other" mechanisms include transfer through technical publications, development of industrial standards and materials, other forms of public dissemination, and opportunities for guest scientists and engineers to participate in Federal laboratory activities. Statistics and descriptions for such "other" mechanisms are included, as they are a 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 to evaluate the effectiveness of technology transfer is based on the stable framework that has been established for the main technology transfer mechanisms. The Department will consider including additional metrics as needed. Specific initiatives under way at each agency are described in Chapters 2, 3, and 4.

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 our quality of life.

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

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

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

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

The present array of metrics covers the wide variety of mechanisms that NIST employs for technology transfer. Throughout the fiscal year, NIST continued to improve its formal patent/licensing policies and procedures by administering a Patent Review Committee to shape patent strategy and utilize resources efficiently; hiring a new experienced technology transfer manager and a new marketing specialist; developing a coordinator for invention disclosure; providing formal intellectual property training sessions at NIST facilities in both Gaithersburg, Maryland, and Boulder, Colorado; implementing a new Small Business Innovation Research (SBIR) Technology Transfer Program to actively stimulate commercialization; and developing a new integrated Web-based system to standardize NIST's guest scientist program. NIST also worked 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 2009, NIST will continue to participate in this program and to expand its technology transfer collaborations with regional economic development and venture capital venues as well as through the Manufacturing Extension Partnership (MEP) network, which reaches over 10,000 manufacturing entities in the United States.

In addition to the technology transfer activity metrics, NIST assesses downstream impacts of 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 outputs as well as to respond to the intrinsic difficulty of measuring the results of 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. 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 44:1. 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

In FY 2008, NIST continued to streamline a new patent policy and procedures put into place in FY 2007. The NIST Director and Operating Unit Directors communicated to NIST staff the importance of these policies and procedures to the continuing transfer and vitality of NIST research. In addition, NIST's Office of Technology Partnerships (OTP) led an ongoing program of informational sessions and meetings. The FY 2008 results compared to those of FY 2007 reflected a 38% increase in the number of invention disclosures and a 167% increase in patent applications filed.

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

In FY 2008, OTP added an additional position, both to provide extra support to NIST staff on patenting and the broad array of collaboration vehicles and to expand its program for marketing NIST technologies. The marketing program organized a nanotechnology showcase intended to introduce the audience to technologies, technical services, NIST research and development facilities available for use, and collaborative research opportunities at NIST.

In FY 2008, the NIST SBIR Program realized the benefits of a pilot approach to use SBIR awards to fund further development of NIST innovations by the private sector. Under this initiative, nearly half of the FY 2008 NIST SBIR awards were made to small businesses that will conduct R&D to commercialize NIST technology. Plans to continue that pilot program are in place for the next SBIR cycle.

● Standard Reference Materials

Standard Reference Materials (SRMs) are one definitive source of measurement traceability in the United States. All measurements using SRMs can be traced to a common, recognized set of basic standards that provides the basis for compatibility of measurements among different laboratories. As economic exchange has become more global, customers increasingly use SRMs to achieve measurement quality and conformance to process requirements that address both national and international needs. 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 1,282—illustrates the breadth 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 high economic benefits delivered to industry.

● Calibration Services

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

Recently, NIST has redefined how it counts individual calibration tests. The change in definition and increased activity related to military test equipment has resulted in an annual level of about 27,000 calibration tests. The number of calibrations in individual years may fluctuate due to multiyear calibration cycles, a shift in emphasis among specific calibration services that have different numbers of tests for each service item, and the overall health of the U.S. economy. NIST's approach is driven by the need to effectively manage trends in demand from its major industry and government customers for these services. NIST is pursuing three strategies: (1) performing only those calibrations that require a direct connection to the national standards; (2) improving calibration accuracy in those areas where new industry demands are emerging; and (3) accrediting primary and secondary calibration laboratories to meet 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 (i.e., sells with terms and conditions or distributes for free) many Standard Reference Data titles (SRDs). SRDs provide numeric data to scientists and engineers for use in technical problem-solving, research, and development. These recommended values are based on data extracted from scientific and technical literature or on measurements done at NIST laboratories, which are then assessed for reliability and evaluated to select the preferred values. 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 2007, a significant new upgrade to Standard Reference Database 23, the NIST Reference Fluid Thermodynamic and Transport Properties Version 8.0, was completed. In FY 2008, a major upgrade was made to the widely used NIST/Environmental Protection Agency/National Institutes of Health 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. Because of the addition of these three products, several PC products covering this scientific area were discontinued.

At the end of FY 2008, there were 102 SRDs available, 49 of which were databases for sale with terms and conditions (including the online Web Thermo Tables), and 53 of which were online systems available for free.

● Software Tools

NIST provides a variety of application software programs and testing tools. NIST develops standards, conformance tests, tools, and methods to ensure quality of software and 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 represent one of the major mechanisms NIST uses to transfer the results of its research to support the Nation's technical infrastructure and provide measurements and standards—vital components of leading-edge research and innovation—to industry, academia, and other government agencies. Each year, NIST's technical staff produces a total of 2,000 to 2,200 publications, with approximately 50 to 60 percent appearing in prestigious scientific peer-reviewed journals. NIST staff author more than 1,100 publications in peer-reviewed journals each year.

Relationships for cooperative research and development between Federal laboratories and outside partners are widely viewed as beneficial settings for technology transfer. Beyond the new know-how and technology that may result, these joint efforts can often confer a mutually advantageous leveraging of partners' resources and technical capabilities and can provide avenues for partners to gain new competencies and absorb new skills.

● Collaborative Research, Guest Researchers, and Facilities Users

Each year hundreds of researchers visit NIST to participate in collaborative projects and/or to use NIST's research facilities. NIST makes its facilities available for limited periods of time to domestic and foreign guest researchers to collaborate with NIST staff on research and development projects of mutual interest or to transfer NIST techniques, procedures, and best practices. NIST also sponsors several formal collaboration programs with universities: 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 work together on a R&D project. CRADAs were

created as a result of the Stevenson-Wydler Technology Innovation Act of 1980, as amended by the Federal Technology Transfer Act of 1986, to encourage Federal laboratories to participate in R&D partnerships for the purpose of advancing promising technologies toward commercialization.

● Conferences, Workshops, and Inquiries

Technology transfer is a "contact sport"; among the most important mechanisms for technology dissemination are communication, education, and interaction among researchers and users of technology. Therefore, NIST also transfers its technology through the hosting of numerous conferences and workshops, and by answering inquiries. During FY 2008, NIST held 83 conferences with about 8,326 attendees and answered more than 6,564 e-mail, telephone, and mail inquiries from the public, including inquiries from many researchers requesting publications or other documents describing NIST research results.

● Participation in Documentary Standards Committees

Still another means by which NIST transfers technology is through staff participation in the activities of documentary standards developing organizations, which develop consensus standards on a host of technologies. NIST participation enables its scientists and engineers to bring NIST technology directly into standards that (for example) could involve test methods and procedures for protecting health, safety, and/or the environment; or specifications for performance or interoperability;. During FY 2008, 404 NIST staff members participated on 985 committees representing 108 standards-developing organizations. NIST staff held 1,398 memberships on these committees, including 399 in ASTM International (formerly the American Society for Testing and Materials), 62 in the American National Standards Institute (ANSI), 89 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 growing number of formal training programs. In FY 2008, 1,051 attendees attended 58 NIST training classes held by 10 NIST divisions. Among the training sessions offered in FY 2008 was the Summer Institute for Middle School Science Teachers (SIMSST) and the Standards in Trade (SIT) workshops. The SIMSST was designed to halt middle school students' loss of interest in science and math by focusing on teacher training. Sixteen teachers participated, under the auspices of a Memorandum of Understanding with Montgomery County Public Schools. All 16 teachers are currently assigned to teach middle school science. The SIT workshops are designed to provide timely information to foreign standards officials on U.S. practices in standards and conformity assessment. A total of four SIT workshops were held in FY 2008.

● **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 its news releases, website, and contacts with the media, NIST publishes Tech Beat, a biweekly lay-language newsletter of recent research results.

Performance in FY 2008: Activities and Achievements

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

In response to the reporting requirements of the Technology Transfer Commercialization Act of 2000 and other relevant legislation, data are provided for collaborative relationships for research and development (CRADAs and other kinds of relationships), invention disclosures and patenting, and licensing. In addition, in keeping with the previous discussion, data are also provided for some of the other technology transfer mechanisms utilized by the NIST laboratories such as: Standard Reference Materials, Standard Reference data, technical publications produced, calibration tests, and guest researcher collaborations. A number of examples of downstream outcomes from NIST technology transfer activities are also provided.

Standard Reference Data (SRD) and Standard Reference Material (SRM) data is included for the first time in this report.

■ Collaborative Relationships for Research and Development

	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
● **CRADA**s, total active in the fiscal year [1]	1,641	1,618	2,488	2,488	2,343
- New, executed in the fiscal year	1,605	1,579	1,646	1,585	1,575
▪ Traditional CRADAs, [2] total active in the fiscal year	51	65	135	140	121
- New, executed in the FY	15	26	74	20	12
▪ Non-traditional CRADAs, [3] total active in the fiscal year	1,590	1,553	2,353	2,348	2,224
- New, executed in the fiscal year	1,590	1,553	1,572	1,565	1,565
● **Other types of collaborative R&D relationships**					
▪ Facility Use Agreements, total in effect, end of the fiscal year [4]	590	588	639	717 [5]	635
- New, executed in the fiscal year	239	280	283	397 [5]	399
▪ Guest scientists and engineers during the fiscal year [6]	1,700	2,115	2,114	2,672	2,816

CRADA = Cooperative Research and Development Agreement.

(1) "Active" = legally 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 under the CRADA authority and material transfer or technical assistance that may result in protected information.

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

(5) 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.

■ Invention Disclosure and Patenting

	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
● New inventions disclosed in the fiscal year [1]	23	19	10	29	40
● Patent applications filed in the fiscal year [2]	12	11	4	6	18
● Patents issued in the fiscal year	11	9	6	3	1
● Active patents, end of the fiscal year	161	154	132	129	131

(1) Inventions arising at Federal 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 to protect inventions in each of its Contracting States.)

■ Licensing

Profile of Active Licenses

	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
● **All licenses**, number total active in the fiscal year [1]	22	26	24	30	23
▫ New, executed in the fiscal year	2	5	3	5	2
▪ **Invention licenses**, total active in the fiscal year	22	26	24	30	23
▫ New, executed in the fiscal year	2	5	3	5	2
- Patent licenses, [2] total active in the fiscal year	22	26	24	30	23
▫ New, executed in the fiscal year	2	5	3	5	2
- 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

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

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

(2) Includes patent applications that are licensed.

Licensing Management

	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
● **Elapsed execution time**, [1] licenses granted in the fiscal year					
▪ **Invention licenses** (Patent licenses) [2]					
▫ Average, months	*	1.0	6.0	2.0	10.5 [3]
▫ Minimum		1.0	1.0	1.0	3.0
▫ Maximum		1.0	13.0	3.0	18.0 [3]
● Licenses terminated for cause, number in the fiscal year					
▪ Invention licenses (Patent licenses) [2]	0	1	0	0	0

* NIST processed no commercialization licenses in FY 2004.

(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.

Characteristics of Licenses Bearing Income

	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
● **All income bearing licenses**, (1) total number	15	17	18	21	21
▫ Exclusive	10	11	16	16	14
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	5	6	2	5	7
▪ **Invention licenses** (Patent licenses), (1) (2) total distributed, income bearing	15	17	18	21	21
▫ Exclusive	10	11	16	16	14
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	5	6	2	5	7
▪ **Other IP licenses**, income bearing	0	0	0	0	0
● **All royalty bearing licenses**, (3) total number	15	17	18	21	21
▪ Invention licenses, royalty bearing	15	17	18	21	21
- Patent licenses, (2) royalty bearing	15	17	18	21	21
▪ **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.

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

Income from Licenses

	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
● **Total income**, all licenses active in FY [1]	$144,828	$123,348	$156,793	$195,347	$223,640
▪ **Invention licenses** (patent licenses) [2]	$144,828	$123,348	$156,793	$195,347	$223,640
▪ **Other IP licenses**, total active in the fiscal year	0	0	0	0	0
● **Total Earned Royalty Income** (ERI) [3] [4]	$144,828	$123,348	$156,793	$195,347	$223,640
▫ Median ERI	n/a	$2,500	$5,000	$15,000	$20,000
▫ Minimum ERI	$640	$640	$640	$1,280	$640
▫ Maximum ERI	$54,072	$45,000	$85,403	$169,067	$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]	$144,828	$123,348	$156,793	$195,347	$223,640
▫ Median ERI	n/a	$2,500	$5,000	$15,000	$20,000
▫ Minimum ERI	$640	$640	$640	$1,280	$640
▫ Maximum ERI	$54,072	$45,000	$85,403	$169,067	$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 year	$0	$0	$0	$0	$0

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

dw = 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" = 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 2004	FY 2005	FY 2006	FY 2007	FY 2008
● **Income distributed** [1]					
▪ **Invention licenses**, (Patent licenses), [2] total distributed	$144,828	$123,348	$156,793	$195,347	$223,640
- To inventor(s)	$54,134 (37%)	$48,148 (39%)	$47,536 (30%)	$65,100 (33%)	$75,140 (33%)
- To other [3]	$90,694 (63%)	$75,199 (61%)	$109,257 (70%)	$130,247 (67%)	$148,500 (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 2004	FY 2005	FY 2006	FY 2007	FY 2008
Standard Reference Materials (SRMs) available [1]	1,211	1,246	1,302	1,285	1,282
Standard Reference Materials (SRMs) units sold [2]	30,490	32,163	31,195	32,614	33,373
Standard Reference Data (SRD) titles available [3]	95	110	113	109	102
Number of calibration tests performed [4]	12,503	12,849	13,127	27,489*	25,944*
Technical publications in peer-reviewed journals [5]	1,070	1,148	1,163	1,272	1,271

* 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.

(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 50% are available for sale, and 50% are free online systems. Over time, a larger percentage of SRDs will be distributed via the Internet. New growth in online systems was anticipated for FY 2008 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 2008*

● Researchers Receive Federal Laboratory Consortium (FLC) Award for Excellence in Technology Transfer

NIST researchers Chris Cromer, John Lehman, and Xiaoyu Li received the FLC's 2008 Award for Excellence in Technology Transfer. They were recognized for their pioneering work in commercializing optical trap detectors for laser power measurements. These optical trap detectors represent the state of the art in calibration transfer standards for laser power measurements and are critical to obtaining traceability through NIST calibration services.

The NIST-designed detector was successfully commercialized by Spectrum Detector, Inc., working in collaboration with the NIST researchers. The commercial availability of a metrology-grade trap-detector transfer will allow companies that manufacture and use laser power and energy meters to obtain stable, high-accuracy transfer standards at a reasonable price.

● NIST/Air Force Research Laboratory (AFRL) Consortium Awarded 2008 Federal Laboratory Consortium for Technology Transfer's (FLC) Interagency Partnership Award

A NIST/AFRL consortium was chosen as the 2008 recipient of the FLC Interagency Partnership Award for the development of the RoboCrane/AMP. The RoboCrane/AMP (Aerial Multiaxis Platform) is a revolutionary robotic platform—developed by NIST, patented, and licensed to the U.S. Technology Corporation—that has been adapted for the U.S. Air Force to address the critical, expensive, and nasty work of stripping old paint from large aircraft. The RoboCrane will make the process of de-painting cargo aircraft more efficient, safer, and more cost-effective.

● R&D 100 Award For New NIST Neutron Detector

A new ultrasensitive, high-bandwidth neutron detector developed by NIST and the University of Maryland was recognized with an R&D 100 Award. The annual R&D 100 Awards recognize "the 100 most technologically significant products introduced into the market" during the previous year, as selected by an independent judging panel and the editors of *R&D Magazine*.

The NIST Lyman alpha neutron detector (LAND) detects neutrons by sensing "Lyman alpha" radiation—in the far ultraviolet region of the optical spectrum at a wavelength of 122 nm—that is produced in neutron absorption by helium-3 gas.

NIST has filed a U.S. patent application on the LAND technology.

● NIST Receives Two Nano 50 Awards

Nanotech Briefs magazine awarded two Nano 50 Awards to NIST researchers at its meeting in Boston, Massachusetts. This award recognizes "the top 50 technologies, innovators, and products that have, or will, significantly impact the development of nanotechnology."

NIST's Michael Postek received a Nano 50 Award for his pioneering achievements in scanning electron microscope image and performance improvements and in fostering accurate critical dimension scanning electron microscopy metrology and national standards for nanotechnology and nanomanufacturing.

The second Nano 50 was awarded to NIST researchers Richard Silver, Ravikiran Attota, Bryan Barnes, Jay Jun, and Michael Stocker for their revolutionary work in scatterfield optical microscopy, a revolutionary measurement technique capable of extending conventional optical metrology instrumentation well beyond their current limits. Using high-throughput low-cost optical metrology instruments, this technique enables imaging of nanometer scale targets used in overlay metrology, linewidth measurements, and defect inspection for the semiconductor and nanoelectronics industries.

Example Outcomes from NIST Technology Transfer Activities

● World Trade Center Study Inspires Strengthened International Building, Fire Codes

Future buildings, especially tall structures, should be increasingly resistant to fire, more easily evacuated in emergencies, and safer overall thanks to 23 major and far-reaching building and fire code changes approved by the International Code Council (ICC) based on recommendations from NIST. The recommendations were part of NIST's investigation of the collapses of New York City's World Trade Center (WTC) towers on September 11, 2001.

The changes, adopted at the ICC hearings held September 15-21, 2008, in Minneapolis, Minnesota, will be incorporated into the 2009 edition of the ICC's I-Codes (specifically, the International Building Code and the International Fire Code), state-of-the-art model codes used as the basis for building and fire regulations promulgated and enforced by U.S. States and local jurisdictions. Those jurisdictions have the option of incorporating some or all of the codes' provisions but generally adopt most provisions.

The new codes address areas such as increasing structural resistance to building collapse from fire and other incidents; requiring a third exit stairway for tall buildings; increasing the width of all stairways by 50 percent in new high-rises; strengthening criteria for the bonding, proper installation, and inspection of sprayed fire-resistive materials (commonly known as "fireproofing"); improving the reliability of active fire protection systems (i.e., automatic sprinklers); requiring a new class of robust elevators for access by emergency responders in lieu of an additional stairway; making exit path markings more prevalent and more visible, and ensuring effective coverage throughout a building for emergency responder radio communications.

● Building Software Offers Green Product Advice

NIST has developed a powerful technique for selecting cost-effective, environmentally preferable building products. Known as BEES® (Building for Environmental and Economic Sustainability), the Windows-based decision support software—aimed at designers, builders, and product manufacturers—includes actual environmental and economic performance data for over 230 building products. The tool is based on consensus standards and designed to be practical, flexible, and transparent. BEES reduces complex, science-based technical content (e.g., over 500 material and energy flows from raw material extraction through product disposal) to decision-enabling results and delivers them in a visually intuitive graphical format.

BEES version 4.0 measures both the environmental and economic performance of building products with life-cycle assessment techniques developed respectively by ISO and ASTM International.

With BEES a user can ascertain, for instance, the environmental impact of a product at any stage of its existence—raw material acquisition, manufacture, transportation, installation, use, and recycling and waste management. BEES provides the environmental ramifications of the product at each of these stages for each of 12 categories: global warming, acidification, eutrophication, fossil fuel depletion, indoor air quality, habitat alteration, human health, ecological toxicity, ozone depletion, smog, criteria air pollutants, and water intake. Developed by a panel of building product manufacturers, green building designers, and environmental assessment experts, the new consensus weight option allows users to evaluate environmental impacts with regard to short-, medium- and long-term effects.

Comprehensive economic performance data are similarly available for the costs of initial investment, replacement, operation, maintenance and repair, and disposal. Environmental and economic performances are combined into an overall performance measure using the ASTM standard for Multi-Attribute Decision Analysis. For the entire BEES analysis, building products are defined and classified according to the ASTM standard classification for building elements known as UNIFORMAT II.

BEES 4.0 includes a number of new non-biobased products, including carpeting from several manufacturers who agree to purchase carbon credits to offset the product's life-cycle greenhouse gas emissions. These and other products, such as biobased carpets, roof coatings, building maintenance products, and fertilizers that qualify for a government "green" preferential purchase program, could increase builder participation in the Nation's drive for green buildings.

The U.S. Department of Agriculture Chief Economist's Office of Energy Policy and New Uses supported NIST's BEES research on biobased products. The U.S. Environmental Protection Agency also makes BEES available through its website.

● NIST Physicists Help an Effort to Eradicate Malaria

Malaria is a mosquito-borne disease that kills more than one million children every year. Researchers at NIST demonstrated their expertise in radiation science by providing calibration services and entering into an informal collaboration with a young company to develop weakened, harmless versions of the malaria-causing parasite. These parasites, in turn, are being used to produce a new type of vaccine that shows promise of being more effective than current malaria vaccines.

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

With their knowledge of measuring radiation doses for industrial processes such as medical equipment sterilization, NIST researchers have been lending their expertise for several years with Maryland-based biotech firm Sanaria Inc., which is creating the new vaccine. In the manufacturing process, live mosquitoes containing the parasite are exposed to gamma rays. To

ensure that the parasites are sufficiently weakened for the vaccine, yet remain alive, they must be exposed to a radiation dose of at least 150 gray (Gy), but not much more.

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

● NIST Introduces New Method for Testing Fireproofing Material

In a high-temperature blaze, how well a fireproofing material shields a building's important steel structures from heat is important information for builders selecting high-performance fire-resistive materials and for scientists conducting computer simulations that investigate fires. Researchers at NIST, in collaboration with others, have developed a technique for measuring a key thermal property of fire-resistive materials at high temperatures. The measurement technique has already been adopted commercially and incorporated into a national standard.

In creating computer simulations to study the collapses of the World Trade Center buildings on September 11, 2001, NIST researchers needed to know important properties of the fireproofing materials that protected structural steel columns. A NIST/industry "Performance Assessment and Optimization of Fire-Resistive Materials" consortium was established to focus on developing measurement technology and test methods for evaluating the thermal and adhesion properties of fire resistive materials. One key property was the thermal conductivity of the material: How quickly does heat transfer through it? Thermal insulation has a low thermal conductivity and metals have a high thermal conductivity. There are long-established methods for measuring thermal conductivity under ambient conditions, but a material's thermal conductivity can change markedly when it is subjected to extremely high temperatures that cause important chemical and structural changes. Traditional methods for measuring thermal conductivity at high temperatures have not been adequate.

NIST developed a "slug calorimeter" technique for obtaining the thermal conductivity information at elevated temperatures. In this technique, they use a thin square slab of steel material known as a slug and sandwich it between slabs of the fireproofing material of interest. Guard insulation surrounds the sides of the sample so that heat flows preferentially through the sandwich when it is placed in a high-temperature furnace. Three temperature probes inserted into the steel slug measure the heat flowing to the steel. Combining this data with the known heat capacities and densities of the steel slug and the fire-resistive material, the researchers can determine the material's thermal conductivity at various temperatures.

Following the successful demonstration of this method at NIST, two large U.S. testing laboratories, Intertek and Southwest Research Institute, have worked with NIST to develop their own in-house slug calorimeters as a testing service to their clients, and a third U.S. company, Anter Corporation, recently introduced a commercial version of a slug calorimeter called the FireLine 1000TM. ASTM International has published a standard (ASTM E 2584) detailing how to conduct thermal conductivity measurements with the new method. Possible applications beyond steel fireproofing material involve measuring the thermal conductivity of wood-based materials as well as the insulating materials used to protect spacecraft such as the space shuttle.

● NIST Improves Medical Imaging

Positron emission tomography (PET) is a powerful imaging tool that helps physicians study chemical and metabolic functions of the body. NIST researchers, collaborating with an Ohio-based nuclear medicine company called RadQual, recognized a need for a nationally traceable standard reference material for PET instrument calibration.

Fluorine-18 is the radioactive isotope of choice in the vast majority of PET procedures. Injected into the bloodstream while bound to "carrier" molecules such as the sugar glucose, fluorine-18 lights up the body during PET scans to reveal tumors, monitor heart activity, and determine which regions of the brain are active during certain tasks.

However, fluorine-18 has a very short life, which makes it impractical to use for calibrating PET instruments. A batch of fluorine-18 decays to half its initial quantity in fewer than two hours, and about one-ten-thousandth of the original amount is left after a single day. A single central laboratory cannot make precise measurements on fluorine-18 solutions and then distribute the solutions to far-flung centers to calibrate PET machines. The lack of a "standard reference" for means that PET-related measurements from center to center, from patient to patient, and—even in the same patient over time—are difficult or impossible to compare with one another.

NIST researchers, collaborating with RadQual, have turned to germanium-68 as a calibration surrogate for fluorine-18. This germanium isotope has similar decay characteristics to fluorine-18, but a longer life (half-life of 270.95 days). Germanium-68 never would be used in actual PET procedures; it would be used only to calibrate the machines properly, enabling more accurate measurements of the fluorine-18 isotopes. Although germanium-68 has been used for performing corrections on PET scanners, the industry has lacked a nationally traceable standard reference material for instrument calibration.

RadQual has developed a commercial product for daily PET calibration routine based on the NIST germanium-68 standard. This standard reference material is a "mock" syringe standard that uses germanium-68 embedded in an epoxy to simulate fluorine-18 in a syringe. This helps researchers more accurately determine the amount of fluorine-18 to be injected into patients during the PET procedure so as to minimize radiation dose while still producing the best image. NIST is also working independently on a germanium-68-based PET "phantom" that can be used to calibrate PET scanners in a way that is traceable back to NIST.

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 global warming, freshwater supply, ecosystem management, and homeland security.

NOAA is one of the Nation's premier scientific agencies. NOAA science and technology impact the daily lives of the Nation's citizens and have a significant effect on the national economy. 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 totally weather-dependent. Weather data and forecasts play a critical role in these major economic sectors of our economy—and are transferred to industry and the public through the media, the 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 has 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 best for the mating of honeybees. Increasingly accurate and longer-range weather forecasts depend on an ongoing program of research and development.

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

NOAA's website 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 Niño prediction and monitoring, tides and currents, satellite imagery, fishery statistics and information on protected species, air quality, state of the coasts, beach temperatures, and nautical charts, as well as extensive databases on climate, oceans, ice, atmosphere, geophysics, and the sun.

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

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

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

NOAA collaborates with other Federal research agencies on science and technology development matters of joint interest. For example, NOAA and the Environmental Protection Agency (EPA) work together 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 worldwide. Through these international relationships, technology is transferred into NOAA for the eventual benefit of U.S. industry and public users. For instance, the understanding and forecasting of global phenomena that occur in the atmosphere, oceans, and on the sun require worldwide collaboration and information-sharing. This is accomplished through formal agreements with individual countries and participation in international organizations, such as the World Meteorological Organization, the Intergovernmental Oceanographic Commission, and the International Astronomical Union. NOAA also participates in international scientific programs and shares technology and scientific data, such as in the Global Earth Observation System. This effort involves nearly 50 other countries, the European Commission, and 29 international organizations. NOAA also provides technical assistance and training to individuals from other countries and participates in a visiting scientist program. In addition, environmental data is shared through NOAA participation in the World Data Center program.

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

Performance in FY 2008: Activities and Achievements

■ Collaborative Relationships for Research & Development

	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
● **CRADA**s, total active in the fiscal year [1]	9	8	6	5	4
- New, executed in the fiscal year	0	0	0	0	1
▪ Traditional CRADAs, [2] total active in the fiscal year	9	8	6	5	4
- 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" = legally in 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 2004	FY 2005	FY 2006	FY 2007 [3]	FY 2008
● New inventions disclosed in the fiscal year [1]	2	1	4	3	0
● Patent applications filed in the fiscal year [2]	0	1	0	2	3
● Patents issued in the fiscal year	1	1	0	0	1

(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 2004	FY 2005	FY 2006	FY 2007	FY 2008
● **All licenses**, number total active in the fiscal year [1]	5	4	5	6	6
▫ New, executed in the fiscal year	0	0	1	3	0
▪ **Invention licenses**, total active in the fiscal year	5	4	5	6	6
▫ New, executed in the fiscal year	0	0	1	3	0
- Patent licenses, [2] total active in FY	5	4	5	6	6
▫ New, executed in the fiscal year	0	0	1	3	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, 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

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

(1) "Active" = legally in force at any time during the fiscal year.
(2) Patent licenses include patent applications which are licensed.

Licensing Management

	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
● **Elapsed execution time**, [1] licenses granted in the fiscal year					
▪ **Invention licenses** (Patent licenses) [2]	*	*	7.0	5.0	*
▫ Minimum				6.0	
▫ Average, months				7.0	
● **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.

* No new licenses were executed
(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.

Characteristics of Licenses Bearing Income

	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
● **All income-bearing licenses**, total number	5	4	5	4	4
▫ Exclusive	1	1	1	0	0
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	4	3	4	4	4
▪ **Invention licenses**, (Patent licenses) [1] income-bearing	5	4	5	4	4
▫ Exclusive	1	1	1	0	0
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	4	3	4	4	4
▪ **Other IP licenses**, income-bearing	0	0	0	0	0
● **All royalty bearing licenses**, [2] total number	5	4	5	4	4
▪ **Invention licenses**, (Patent licenses) [1] royalty-bearing	5	4	5	4	4
▪ **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.

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

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

Income from Licenses

	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
● **Total income**, all licenses active in the FY [1]	$24,961	$16,100	$13,100	$22,000	$69,007
▪ **Invention licenses** (Patent licenses) [2]	$24,961	$16,100	$13,100	$22,000	$69,007
▪ **Other IP licenses**, total active in the FY	$0	$0	$0	$0	$0
● Total Earned Royalty Income (ERI) [3]	$24,961	$16,100	$13,100	$22,000	$69,007
▫ Median ERI	$1,923	$1,000	$1,000	$4,000	$9,007
▫ Minimum ERI	$116	$100	$100	$1,000	$1,000
▫ Maximum ERI	$21,000	$9,000	$5,000	$9,000	$25,000
▫ ERI from top 1% of licenses	$21,000	$9,000	$5,000	$9,000	$25,000
▫ ERI from top 5% of licenses	$21,000	$9,000	$5,000	$9,000	$25,000
▫ ERI from top 20% of licenses	$21,000	$9,000	$5,000	$9,000	$25,000
▪ **Invention licenses** (Patent licenses) [2]	$24,961	$16,100	$13,100	$22,000	$69,007
▫ Median ERI	$1,923	$1,000	$1,000	$4,000	$9,007
▫ Minimum ERI	$116	$100	$100	$1,000	$1,000
▫ Maximum ERI	$21,000	$9,000	$5,000	$9,000	$25,000
▫ ERI from top 1% of licenses	$21,000	$9,000	$5,000	$9,000	$25,000
▫ ERI from top 5% of licenses	$21,000	$9,000	$5,000	$9,000	$25,000
▫ ERI from top 20% of licenses	$21,000	$9,000	$5,000	$9,000	$25,000
▪ **Other IP licenses**, total active in the FY	$0	$0	$0	$0	$0

(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" = 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 Invention License Income

	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
● Income distributed [1]	$24,961	$16,100	$13,100	$22,000	$69,007
▪ Invention licenses, (Patent licenses), [2] total distributed					
- To inventor(s)	$11,070 (44%)	$8,400 (52%)	$7,500 (57%)	$12,200 (55%)	$21,802 (32%)
- To other	$13,891 (56%)	$7,700 (48%)	$5,600 (43%)	$9,800 (45%)	$46,205 (68%)

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

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

■Other Performance Measures Deemed Important by the Agency

	FY 2004	FY 2005	FY 2006	FY 2007 *	FY 2008
Journal articles published	419	397	444	584	515
Technical reports published	300	226	148	196	103

* Update made for FY 2007 on number of articles published and reports published.

GREAT LAKES ENVIRONMENTAL RESEARCH LABORATORY	FY 2004	FY 2005
Website hits (HTML pages)	2,244,420	3,086,605
Website downloads (PDF pages)—brochures, research papers, technical memos, etc.	65,740	110,880

Other Performance Measures Deemed Important by the Agency

■ Prestigious Awards for NOAA's Scientific Technology received in FY 2008

● Service to America Medal:

Dr. Eddie Bernard, Director of NOAA's Pacific Marine Environmental Laboratory (PMEL), has become the first NOAA scientist to be awarded a Service to America Medal for his work in establishing an international tsunami detection and forecast system named DART (Deep-ocean Assessment and Reporting of Tsunamis). PMEL's patent for this system was assigned on October 30, 2007.

● NOAA Technology Transfer Awards:

Personnel from three NOAA laboratories received NOAA's Technology Transfer Award:

- Christian Meinig and Scott Stalin of the Pacific Marine Environmental Laboratory received the award for the invention of DART technology, which allows NOAA to produce accurate tsunami forecasts and, through patent and license, has generated new U.S. jobs;

- Kurt Hondl of the National Severe Storms Laboratory received the award for team leadership during the development of the Warning Decision Support System-Integrated Information for fostering its adopted use in the private sector

- John A. McGinley, John R. Smart, Linda S. Wharton, and David M. Birkenheuer of the Earth System Research Laboratory received the award in recognition of the Local Analysis and Prediction System's technology transfer to support development and implementation of the Precision Airdrop System supporting airdrop activities worldwide.

Example Outcomes 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:

● Deep-ocean Assessment and Reporting of Tsunamis (DART®)

The first Deep-ocean Assessment and Reporting of Tsunamis (DART®) station was launched in the Indian Ocean in December 2006. In FY 2008, the PMEL continued to support efforts to transfer tsunami-related technology used to improve warnings worldwide. Familiarization and training were provided to the Science Applications International Corporation DART® team from September 22, 2008, to October 3, 2008, in support of the Special Studies Agreement to assist the technology transfer to the commercial sector. Memorandums of Understanding (MOUs) in place with Indonesia and Australia resulted in Australia's establishment of a second DART® station supported by Australia, located in the Coral Sea. A training deployment cruise from Indonesia was undertaken by PMEL and Indonesian engineers in June 2008 under the auspices of the U.S. Agency for International Development (USAID) MOU. Data from all DART® buoys is available online in real time at http://www.ndbc.noaa.gov/dart.shtml.

● Tsunami Science Training

In March 2008, staff from NOAA, the University of Washington, and the Asian Institute of Technology conducted the second offering of the Tsunami Science and Preparedness (TSP) Program, hosted by AIT in Bangkok, Thailand. The TSP is a two-week program to train tsunami warning and preparedness officials, and is part of USAID's response to the December 2004 Indonesian tsunami. The goal of the program is to increase resilience to tsunamis in the Indian Ocean region by providing training to national government and community officials to improve preparedness, communication, warning, and mitigation capabilities in at-risk communities. This second TSP offering included 38 scientific researchers, National Warning Center staff, community-level workers and emergency managers from Indian Ocean nations. Subject-matter experts from PMEL, the Pacific Tsunami Warning Center, the University of Washington, the U.S. Geological Survey, the State of Washington, and other entities instructed the students in all aspects of tsunami preparedness during the two-week class.

In September 2008, PMEL, the United States Geological Survey, and Washington State staff conducted a community-specific Tsunami Education Workshop as part of a pilot program to develop an Educational Strategic Plan for the National Tsunami Hazard Mitigation Program (NTHMP). The one-day workshop was designed to transfer knowledge of tsunami science and preparedness to 25 participants, including officials and residents of the Shoalwater Bay Tribe, which hosted the workshop, and the community of Tokeland in Washington State.

● Community Model Interface for Tsunami (ComMIT) Training

At the Second Session of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System in December 2005, a recommendation was made to establish a Web-based community model. It was envisioned that the community model and the associated tools would be the primary avenue to transfer modeling expertise and capabilities to and among the Indian Ocean countries. The community model would provide tools for the

construction of tsunami inundation maps under different scenarios and for real-time tsunami forecast applications and thus becomes a critical tool for building tsunami resilient communities.

A "community" model is one which is non-commercial and freely available with source code and documentation for use by the scientific community. USAID and the United Nations Education Scientific and Cultural Organization funded NOAA's PMEL to develop the model, which has been named ComMIT. The model allows nations access to modeling tools with an Internet-enabled interface. ComMIT enables government agencies and others in the region to run tsunami models, using data from local or remote databases. This approach has several advantages: (1) it allows nations without a significant cadre of trained modelers to build tsunami modeling capability for forecast and hazard assessment; (2) it allows nations with restrictions on sharing geospatial data to input that data locally and not share it with other Web-based model users, but at the same time share the model results regionally or globally; and most significantly, (3) the Internet-based approach creates a virtual regional and global community of modelers using the same tools and approaches to understand tsunami threats, all able to share information and insights among themselves.

In 2008, ComMIT training was provided in the Seychelles Islands (January); Cadiz, Spain (April); and in Valparaiso, Chile (May) to a total of 65 scientists, in support of the development of regional tsunami warning capabilities.

● Detection Method for Brevetoxin

A detection method for brevetoxin developed as a partnership between the National Centers for Coastal Ocean Science (NCCOS) and AgResearch Ltd (New Zealand) is being produced as a diagnostic test kit by Abraxis, a U.S. small business specializing in environmental diagnostics. The detection method, known as a direct formatted enzyme-linked immunosorbent assay, has been in use by NCCOS for two years to quantify brevetoxins in support of NCCOS research and a proof-of-concept project in Florida to biomonitor brevetoxins in marine mammals, turtles, and seabirds during rehabilitation of red tide poisoning. The test kit will be released in early February 2009.

● Air Quality Forecast Guidance

The United States needs a national air quality forecasting (AQF) capability. Air quality has improved significantly in recent decades, following passage of the Clean Air Act in 1970. However, there are still many areas of the country where the public is exposed to unhealthy levels of air pollutants and sensitive ecosystems are damaged by air pollution. The cost of poor air quality to the U.S. from air pollution-related illness alone has been estimated at $150 billion per year. Forecasting impending poor air quality can provide early notice and warning to individuals and communities to help them limit exposure and reduce asthma attacks; eye, nose, and throat irritation; and other respiratory and cardiovascular problems, and can even save lives. For each 1 percent reduction in adverse health impacts that AQF could provide, over $1 billion would be saved every year. In order to help the Nation realize these benefits, Congress has directed NOAA to provide national AQF guidance.

NOAA and EPA have entered into a partnership to make full use of their respective capabilities and authorities in developing a national AQF capability. The goal of this partnership is to provide forecasts for ozone, particulate matter, and other pollutants with enough accuracy and advance notice for people to take action to prevent or limit harmful effects from poor air quality.

EPA, responsible for collecting and updating a national inventory of emissions, provides these data to NOAA for use in the AQF capability. Through its relationships with State and local air quality agencies, EPA's AIRNow Program also collects air quality monitoring data and sends them to NOAA. NOAA incorporates these emissions data and NOAA weather observations into operational AQF model predicted concentration fields. State and local agencies use this guidance to issue air quality forecasts and Air Quality Index predictions in their jurisdictions. EPA nationally distributes information from State and local air quality forecast agencies. The private sector also uses State and local forecast information and disseminates it to the public.

The NOAA/EPA partnership provides more sophisticated tools and advances the power of air quality forecasting. Over the past decade, more State and local agencies have begun to make air quality forecasts for their communities. Today, about 300 cities powered national forecasting technology and guidance which supports local weather forecasts. For localities that have been forecasting air quality, the new NOAA forecasting guidance will improve forecasters' ability to predict the onset, severity, and duration of poor air quality. For communities in most of the country, this has been the first time that air quality predictions have been made available.

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 2008, 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 and advanced antennas for wireless systems 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 2008, 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 2008: Activities and Achievements

■ Collaborative Relationships for Research & Development

	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008 (1)
● **CRADA**s, total active in the fiscal year (1)	319	278	514	285	41
- New, executed in the fiscal year	185	185	512	280	7
▪ Traditional CRADAs, (2) total active in the fiscal year	7	7	8	9	6
- New, executed in the fiscal year	3	5	6	4	6
▪ Non-traditional CRADAs, (3) total active in the fiscal year	312	273	506	276	35
- New, executed in the fiscal year	182	144	506	276	1
● **Other types of collaborative R&D relationships**					
▪ Collaborative standards contributions, (4) total active in FY	11	11	16	25	25
-New, executed in the fiscal year	0	0	5	9	10

CRADA = Cooperative Research and Development Agreement.

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

(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" = legally 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 2007, 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 2004	FY 2005	FY 2006	FY 2007	FY 2008
● New inventions disclosed in the fiscal year [1]	0	1	0	0	0
● Patent applications filed in the fiscal year [2]	0	0	1	0	0
● Patents issued in the fiscal year	0	0	1	0	0
● Active patents, end of the fiscal year	6	6	8	7	7

(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 2004	FY 2005	FY 2006	FY 2007	FY 2008 *
● **All licenses**, number total active in the fiscal year [1] [2]	98	103	82	186	0
▫ New, executed in the fiscal year	98	103	79	179	0
▪ **Invention licenses**, total active in the fiscal year	98	103	82	186	0
▫ New, executed in the fiscal year	98	103	79	179	0
- Patent licenses, [3] total active in the fiscal year	3	3	7	10	0
▫ New, executed in the fiscal year	3	0	4	3	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	95	100	75	176	0
▫ New, executed in the fiscal year	95	100	75	176	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 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 2004	FY 2005	FY 2006	FY 2007	FY 2008 *
● **Elapsed execution time**, (1) licenses granted in the fiscal year					
▪ Invention licenses (Patent licenses) (2)					
▫ Average (or median), months	2.0	2.0	1.5	1.0	0
▫ Minimum	1.0	1.0	1.0	0.5	0
▫ Maximum	3.0	3.0	2.0	1.5	0
● **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 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 2004	FY 2005	FY 2006	FY 2007	FY 2008 *
● **All income-bearing licenses**, total number	3	4	7	10	0
▫ Exclusive	0	0	0	0	0
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	3	4	7	10	0
▪ **Invention licenses**, (Patent licenses), (1) income-bearing	3	4	7	10	0
▫ Exclusive	0	0	0	0	0
▫ Partially exclusive	0	0	0	0	0
▫ Non-exclusive	3	4	7	10	0
▪ **Other IP licenses**, income-bearing	0	0	0	0	0
● **All royalty-bearing licenses**, (2) total number	3	4	7	0	0
▪ **Invention licenses**, (Patent licenses) (1) royalty-bearing	3	4	7	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 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 2004	FY 2005	FY 2006	FY 2007	FY 2008 *
● **Total income**, all licenses active in the fiscal year (1)	$33,500	$7,212	$24,500	$7,500	$0
▪ **Invention licenses** (Patent Licenses) (2)	$33,500	$7,212	$24,500	$7,500	$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 FY 2008 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" = 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 2004	FY 2005	FY 2006	FY 2007	FY 2008 *
● **Income distributed** (1)					
▪ **Invention licenses**, (Patent licenses), (2) total distributed	$33,500	$7,212	$24,500	$7,500	$0
- To inventor(s)	$18,450 (55%)	$3,564 (49%)	$15,750 (64%)	$5,050 (67%)	$0
- To other (3)	15,050 (45%)	$3,648 (51%)	$8,750 (36%)	$2,450 (33%)	$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 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 2004	FY 2005	FY 2006	FY 2007	FY 2008
Technical publications produced	17	19	8	3	15
Total number of hits on online publications	--	--	1,116,573	1,426,125	1,526,409

-- = 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.

Example Outcomes 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 opensource download. ITS set up a website to take applications for free VQM downloads. During FY 2008, 315 VQM evaluation software downloads were executed.

• 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 2006, a small local company, Johnson's Jobs, performed antenna testing at the Table Mountain turntable facility under a CRADA. Another small company, RF Metrics, performed research under a

CRADA entitled “A Study of the Use of a New Antenna Pattern Collection Technique for Radar Emissions.” Lockheed Martin Coherent Technologies is currently in the middle of a yearlong CRADA to perform field-testing and characterization of components, subsystems, and systems for eye-safe coherent laser radar.

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.