SUPPLEMENT TO:
Department of Commerce, FY 2004 Annual Budget Submission

Annual Report on Technology Transfer: Approach and Plans, FY 2002 Activities and Achievements

U.S. Department of Commerce

Report prepared by:

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

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Background. This is the 2003 edition of a report series summarizing the technology transfer activities and achievements of the Department of Commerce's federal laboratories. This report responds to the statutory requirement for an annual "agency report on utilization" [15 U.S.C. Section 3710 (f)] under the revised federal-wide reporting process established by the Technology Transfer Commercialization Act of 2000 (P.L. 106-404). All federal agencies that direct one or more federal laboratories or conduct other activities under Section 207 and 209 of Title 35, United States Code are subject to the requirements of this statute.

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

Each of the major sections of this report is organized to summarize the agency's technology transfer approaches and plans and to provide specific information about the activities and accomplishments for FY 2002 and several earlier comparative years. The report begins with a summary of this information for the Department of Commerce as a whole.

This report has been organized and prepared by the Office of Technology Policy (Technology Administration), along with the extensive participation of technology transfer personnel at the National Institute of Standards and Technology (Technology Administration), the National Oceanic and Atmospheric Administration, and the Institute for Telecommunication Sciences (National Telecommunications and Information Administration).

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I. DEPARTMENT OF COMMERCE OVERVIEW

Technology Transfer by the Department's Federal Laboratories – Summary of Approaches and FY 2002 Activities/Achievements

The Department of Commerce works in partnership with businesses, universities, communities, and workers to promote U.S. competitiveness. 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 underway at the federal laboratories of the Technology Administration (the National Institute of Standards and Technology -- NIST), National Oceanic and Atmospheric Administration (various lab facilities across NOAA's bureaus), and the National Telecommunications and Information Administration (Institute for Telecommunication Research – ITS). Technology transfer is part of the program activities at each of these federal agencies.

In reviewing the technology transfer plans and activity statistics below, it is important to recognize there are significant differences among the agencies in the level of resources supporting R&D activities. For NIST, budget authority (actual, excluding congressional add-ons in the construction appropriation) in FY 2002 for R&D (basic research, applied research, development, R&D facilities and equipment) totaled $461 million. The corresponding NIST estimate for FY 2003 (February 2003 action by Congress) is $476 million. For NOAA, the FY 2002 figure for R&D is $677 million and that for FY 2003, $684 million. For ITS, the FY 2002 figure is $6 million, and also $6 million in FY 2003.

Agency Missions and Main Channels for Technology Transfer

Mission	Tech Transfer
Technology Administration – National Institute of Standards and Technology NIST's mission is to develop and promote measurement, standards, and technology to enhance productivity, facilitate trade, and improve the 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 focus of NIST's technology transfer activities in general is the broad dissemination of research results to industry, rather than the creation of patents and associated licenses. As such, NIST utilizes a diverse group of mechanisms to transfer the knowledge and technologies that result from its laboratory research. Principal tech tranfer mechanisms: CRADAs, Patents and licenses, Technical publications, Standard Reference Materials,

Mission	
	Standard Reference Data, Calibration services, Documentary standards Conferences, workshops, and inquiries Guest researchers and facilities users.
National Oceanic and Atmospheric Administration NOAA's primary mission is to transfer environmental data on a wide range of time and space scales in order to protect life and property, and provide industry and government decision-makers with a reliable base of scientific information. As part of this mission, almost half of the organization works to produce the daily weather forecast, which advises and warns the general public and, at the same time, provides a base of scientific and technical information for engineers and managers in federal and state governments and in the heating, construction, manufacturing, transportation, and health industries.	? NOAA's broad approach to tech transfer involves licensing intellectual property, cooperative research relationships with industry, and/or direct transfer. NOAA works with each of its laboratories based on its ability to provide the necessary resources. Principal tech tranfer mechanisms: Dissemination CRADAs, Patents and licenses
National Telecommunications and Information Administration -- Institute for Telecommunication Sciences NTIA's Institute for Telecommunication Sciences (ITS) supports agency telecommunications objectives such as promoting advanced telecommunications and information infrastructure development in the United States, enhancing domestic competitiveness, improving foreign trade opportunities for U.S. telecommunications firms, and facilitating 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 participates in tech transfer and commercialization by fostering cooperative research with industry where benefits can directly facilitate U.S. competitiveness and market opportunities. Principal tech tranfer mechanisms: CRADAs, Patents and licenses, Telecommunications analysis services.

For a more detailed discussion, see the initial section of each of the three agency chapters below.

¦ Summary of Departmental Technology Transfer Activities and Achievements, FY 2002 and Recent Years

? Selected Activity Measures

Collaborative Relationships for Research & Development

		1999	FY 2000	FY 2001	FY 2002
? CRADAs, total active in the FY[1]					
? Traditional CRADAs[2]	Department	275	221	183	132
	NIST	261	208	174	125
	NOAA	8	10	3	1
	ITS	6	3	6	6

		FY 1999	FY 2000	FY 2001	FY 2002
? Non-traditional CRADAs[3]	Department	--	--	59	1,744
	NIST	--	--	0	1,687
	NOAA	0	0	0	0
	ITS	--	--	59	57
? Other types of collaborative R&D relationships[4]					
? Facility use agreements	NIST	--	--	372	391
? Guest scientists and engineers	NIST	--	--	1,200	1,300
? Collaborative standards contributions	ITS	--	--	3	3

CRADA = Cooperative Research and Development Agreement. -- = Data not requested from agency in previous years' reports.

(1) "Active" = legally in force at any time during the FY. "Total active" is comprehensive of all agreements executed under CRADA authority (15 USC 3710a).
(2) CRADAs involving collaborative research and development by a federal laboratory and non-federal partners.
(3) CRADAs used for special purposes -- such as, material transfer or technical assistance that may result in protected information.
(4) For details on these measures see the respective agency's chapter later in this report.

Invention Disclosure and Patenting

		FY	FY	FY	FY
? New inventions disclosed in the FY[1]	Department	38	34	26	17
	NIST	35	32	24	16
	NOAA	3	2	1	1
	ITS	0	0	1	0
? Patent applications filed in the FY[2]	Department	30	20	12	12
	NIST	27	18	9	11
	NOAA	2	2	3	0
	ITS	1	0	0	1
? Patents issued in the FY	Department	28	18	21	20
	NIST	26	14	20	15
	NOAA	2	2	1	5
	ITS	0	2	0	0

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

Licensing -- Profile of Active Licenses

		FY	FY	FY	FY
? All licenses, number total active in the FY [1]	Department	41	41	39	40
? Invention licenses, total active in the FY	Department	41	41	39	40
- Patent (and patent application) licenses	Department	41	41	39	40
	NIST	40	39	36	35
	NOAA	0	0	1	2
	ITS	1	2	2	3
- Material transfer licenses (inventions)		0	0	0	0
- Other invention licenses		0	0	0	0
? Other IP licenses, total active in the FY	Department	0	0	0	0
- Copyright licenses (fee bearing)		0	0	0	0
- Material transfer licenses (non-inventions)		0	0	0	0
- Other		0	0	0	0

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

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

Note: For simplicity, sub-departmental detail is suppressed in this table, where the appropriate disaggregated figures are straightforwardly evident from data listed in other rows.

Licensing -- Profile of Active Licenses (cont.)

		FY	FY	FY	FY
? Licenses which are income bearing, total number	Department	19	17	21	38
? Invention licenses which are income bearing	Department	19	17	21	38
- Patent (and patent application) licenses	Department	19	17	21	38
	NIST	18	16	19	33
	NOAA	0	0	1	2
	ITS	1	1	1	3
? Exclusive/part-excl./non-excl.	Department	--	--	13/5/3	19/2/17
	NIST	--	--	12/5/2	18/2/13
	NOAA	--	--	1/0/0	1/0/1
	ITS	0/0/1	0/0/1	0/0/1	0/0/3
? Other IP licenses which are income bearing		0	0	0	0

		FY	FY	FY	FY
? Licenses which are royalty bearing, total number		19	17	21	35
? Invention licenses which are royalty bearing		19	17	21	35
- Patent (and patent application) licenses	Department	19	17	21	35
	NIST	18	16	19	33
	NOAA	0	0	1	2
	ITS	1	1	1	0
? Other IP licenses which are royalty bearing		0	0	0	0

-- = Data not requested from agency in previous years' reports.

*This number includes two royalty-free research licenses. Thus, in FY 2002, NIST had 35 active licenses, with 33 producing royalty income.

Note: For simplicity, sub-departmental detail is suppressed in this table, where the appropriate disaggregated figures are straightforwardly evident from data listed in other rows.

Income from Licensing

		FY	FY	FY	FY
? Total income received, all licenses active in the FY [1]		$405,369	$186,268	$268,468	$163,189
? Invention licenses		$405,369	$186,268	$268,468	$163,189
- Patent (and patent app.) licenses	Department	$405,369	$186,268	$268,468	$163,189
	NIST	$394,387	$122,575	$261,968	$89,750
	NOAA	$0	$0	$1,500	$7,969
	ITS	$10,982	$63,693	$5,000	$65,470
? Other IP licenses, total active in the FY		$0	$0	$0	$0
? Total Earned Royalty Income (ERI) [2]		$405,369	$186,268	$263,468	$97,719
? Invention licenses		$405,369	$186,268	$263,468	$97,719
- Patent (and patent app.) licenses	Department	$405,369	$186,268	$263,468	$97,719
	NIST	$394,387	$122,575	$261,968	$89,750
	NOAA	$0	$0	$1,500	$7,969
	ITS	$10,982	$63,693	$0	$0
? Other IP licenses, total active in the FY		$0	$0	$0	$0

n/a = Data not available from agency at time of this report. -- = Data not requested from agency in previous years' reports.
(1) Total income includes license issue fees, earned royalties, minimum annual royalties, paid-up license fees, and reimbursement for full-cost recovery of goods and services provided by the lab to the licensee including patent costs.
(2) "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.

Note: For simplicity, sub-departmental detail is suppressed in this table, where the appropriate disaggregated figures are straightforwardly evident from data listed in other rows.

Disposition of License Income

		FY	FY	FY	FY
? Income distributed[1]					
? Invention licenses, total distributed	Department	$421,635	$186,268	$268,468	$163,189
	NIST	$394,387	$122,575	$261,968	$89,750
	NOAA	$0	$0	$1,500	$7,969
	ITS	$10,982	$63,693	$5,000	$65,470
- To inventor(s)	Department	$146,957 (36%)	$77,931 (43%)	$106,440 (39%)	$74,660 (46%)
	NIST	$142,262 (36%)	$57,423 (47%)	$102,040 (39%)	$45,650 (51%)
	NOAA	$0 (0%)	$0 (0%)	$1,500 (100%)	$7,969 (100%)
	ITS	$4,695 (43%)	$20,508 (32%)	$2,900 (58%)	$21,041 (32%)
- To other[2]	Department	$258,412 (64%)	$108,337 (57%)	$162,028 (61%)	$88,529 (54%)
	NIST	$252,125 (64%)	$65,152 (53%)	$159,928 (61%)	$44,100 (49%)
	NOAA	$0 (0%)	$0 (0%)	$0 (0%)	$0 (0%)
	ITS	$6,287 (57%)	$43,185 (68%)	$2,100 (42%)	$44,429 (68%)

(1) Income includes royalties and other payments received during the FY.
(2) To internal purposes, in the case of each agency.

Other Important Mechanisms for Technology and Knowledge Transfer[1]

		FY	FY	FY	FY
Standard Reference Materials (SRMs) available	NIST	1,288	1,292	1,335	1,353
Standard Reference Materials (SRMs) sold	NIST	33,347	34,020	31,985	30,996
Standard Reference Data (SRD) titles available	NIST	60	63	65	90
Number of items calibrated	NIST	3,118	2,969	3,192	2,924
Technical publications produced	NIST	2,270	2,250	2,207	2,236
	ITS	32	20	17	17

(1) See the NIST and ITS chapters later in this report for definitions and further information on these measures.

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

? *Illustrative Outcomes from Technology Transfer Cited by the Agencies*

The following cases were selected and described by the agencies in their 2003 reports as examples of "downstream" outcomes resulting from agency technology transfer efforts:

Agency	Downstream Outcomes Listed
Technology Administration -- National Institute of Standards and Technology	? Nobel Prize (2001) to NIST researcher, Eric A. Cornell – member of physics research team that created the first Bose-Einstein condensate (a new form of matter). ? New device to study material weathering – collaboration of NIST researchers with industry and government partners yielded a revolutionary new device to quickly and accurately determine the damage to polymer coatings, materials, and structures from exposure to solar ultraviolet rays, temperature, and humidity. ? Reference sample chip carrier – transfer and deployment to all the world's major semiconductor fabrication facilities of a new, NIST designed/developed "reference sample chip carrier" to aid in semiconductor manufacture. ? Glass Standard Reference Material (SRM) for identification of chemical substances – a new NIST standard that reduces the cost to calibrate Raman spectrometers by up to 20-fold, which makes Raman much more feasible for applications such as crime scene analysis or other out-of-lab chemical identifications. ? Irradiation applications for bioterror mitigation – NIST worked with the U.S. Postal service and industrial radiation processors, in the wake of the late 2001anthrax threat, to establish effective procedures for using radiation processing technology to sanitize large volume U.S. mail flows. ? Software for smoke management guide – NIST developed software to model how pollutants, smoke, and other contaminants are transported throughout a building and predict the effects of building design changes on airflow now part of widely-used ASHRAE guidelines for heating/refrigeration/air-conditioning engineers. ? NIST gas standards – equipment calibration standards developed by NIST for accurate, real-time monitoring of pollution gases provides significant public benefit in emission standards for electric utilities, automobiles, and other sources. ? Suite of international standards that reduce interoperability problems in the exchange of digital product information – NIST activities have

Agency	Downstream Outcomes Listed
	accelerated the development and adoption of the Standard for Exchange of Product Model data (STEP – formally, ISO 10303).
National Oceanic and Atmospheric Administration	? Receptor technologies for harmful algal bloom toxins – receptor based assays developed by NOAA scientists for each class of algal toxin found in U.S. coastal waters transferred to several government (federal, state) and university organizations for field application. ? Verification system to improve aviation forecasts – transfer to government and private sector users of new interactive, Web-based verification system (which consistently, independently, and in near real time computes statistical results for aviation forecasts) developed by NOAA scientists in cooperation with the Federal Aviation Administration and National Center for Atmospheric Research. ? Real-time radar data archival and internet delivery system -- transfer to public and private sector users of NOAA's CRAFT (Collaborative Radar Acquisition Field Test) system, which provides relatively inexpensive, real-time access to high resolution radar data to support critical decisions related to severe weather and flood forecasts.
National Telecommunications and Information Administration -- Institute for Telecommunication Sciences	? Cellular test equipment – licensing of ITS-developed MNB speech quality estimation algorithm to a U.S. manufacturer for incorporation in test equipment for cellular phone service providers. ? Personal communications services – cooperative R&D with a major IT industry research laboratory on multiple input/multiple output antenna arrays (a technology targeted to dramatically increase the capacity of wireless communications systems). ? Local multipoint distribution services – continuing cooperative R&D with industry partners on radio propagation for LMDS, which (among other results) has provided a data foundation for domestic and international standards development and efficient allocation of radio frequency spectrum resources. ? Digital video communication research – continuing cooperative research with university partners on digital video communication applications including video telephony and teleconferencing, telemedicine, and interactive video distribution. ? Video quality assessment system – cooperative research with a partner that is developing a Windows-based video quality management system for wide commercial use.

See the agency chapters below for further details on these cases.

Progress in Improving the Agencies' Performance Metrics for Technology Transfer

This year's performance report is revised and somewhat enlarged, in keeping with the updated guidelines on reporting published by the Interagency Working Group on Technology Transfer/Department of Commerce in December 2002. These new guidelines incorporated a number of data/process revisions intended to respond to issues arising in last year's (CY 2002) reporting cycle -- the first under the Technology Transfer Commercialization Act. Attention to a more sharply defined array of license types was also requested.

This year's report provides a comprehensive set of statistics for each of the agencies on "mainstream" technology transfer activities: cooperative research and development relationships, invention disclosure/patenting, and licensing. There is also a new round of case illustrations of downstream outcomes (e.g., commercially significant technologies) resulting from federal lab technology transfer activities.

Also further developed this year are the agencies' discussions of their technology transfer through mechanisms beyond these mainstream approaches – activities such as transfer through technical publications, development of industrial standards, other forms of public dissemination, and opportunities for guest scientists and engineers to participate in federal lab activities. Each of the agencies now indicate the important roles these "other" mechanism play in their overall approaches to technology transfer. The agencies' plans for improving the performance reports in future years particularly emphasize the development of better metrics in this arena.

II. TECHNOLOGY ADMINISTRATION -- NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

Technology Transfer at the Agency's Federal Laboratories – Approach and Plans, FY 2002 Activities/Achievements

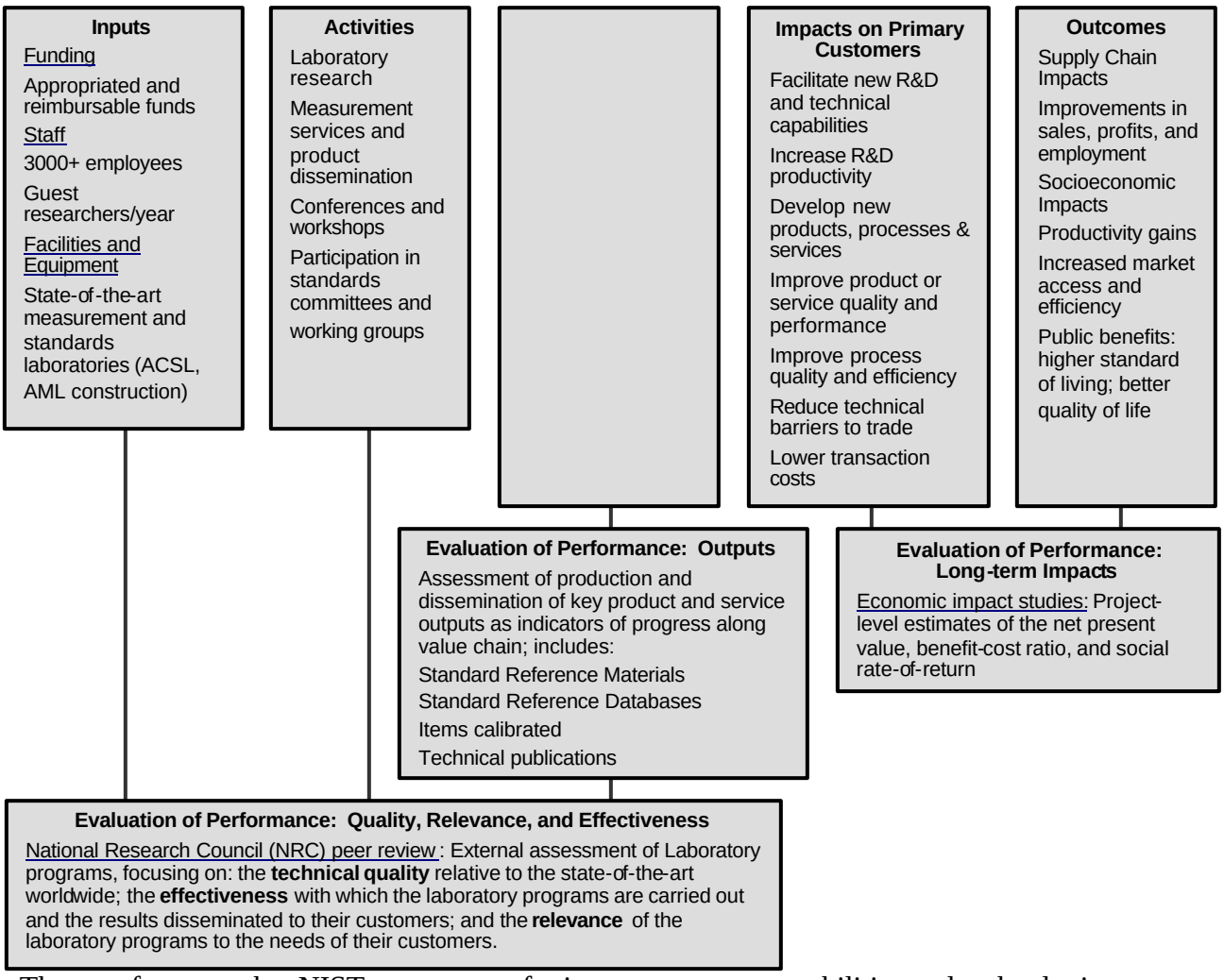
1. Agency Approach and Plans for Technology Transfer

The mission of the National Institute of Standards and Technology (NIST) is to develop and promote measurements, standards, and technology to enhance productivity, facilitate trade, and improve the quality of life. 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 (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. NIST pursues patents, licensing agreements, and related technology transfer as one of several means for transferring the knowledge and technologies that result from its laboratory research. Generally, NIST has the broadest possible downstream leverage when it uses diverse technology dissemination channels, ranging from reference materials and calibration services to technical publications and guest researchers, as well as patents, licensing agreements, CRADA's, and the like.

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—including, but not limited to, CRADAs and patent licensing—to collaborate with industry and to ensure that the resulting knowledge and infrastructural technologies are broadly disseminated.

While NIST does conduct "traditional" technology transfer activities (participate in CRADAs, hold patents, and engage in licensing), its laboratories create patents and licenses, where appropriate, as *tools* to accomplish NIST's mission. These and other technology transfer mechanisms such as workshops, conferences, and partnering tools, as well as SRM's, calibrations, and participation in documentary standards committees, enable NIST to disseminate its measurement capabilities to customers. Together, they represent major outputs that NIST's customers use in their R&D activities, production processes, service delivery methods, market transactions, and other economically valuable activities. This sequence of activities, along with the methods NIST uses to evaluate them, are depicted in the following logic model:



The set of outputs that NIST uses to transfer its measurement capabilities and technologies to customers includes standard reference materials, calibration services, and other products and services that are described below.[1]

- **Standard Reference Materials**

  Standard Reference Materials (SRMs) are the definitive source of measurement traceability in the United States. All measurements using SRMs can be traced to a common and recognized set of basic standards that provides the basis for compatibility of measurements among different laboratories. As economic exchange has become more global, customers increasingly use SRMs to achieve measurement quality and conformance to process requirements that address both national and international needs for commerce and trade. NIST produces and disseminates (sells) 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.

[1] Please note that NIST's authority to perform its technology/knowledge transfer activities does not rest solely in the Bayh-Dole Act, Stevenson-Wydler Act, Federal Technology Transfer Act (FTTA) and related legislation. It also resides in NIST's Organic Act (15 USC 272) and the Standard Reference Data Act (15 USC 290).

The number of SRMs available for sale -- currently over 1,300 -- illustrates the breadth of measurements supported by NIST. Over time, NIST expects slight growth in the number of SRMs available, given its current strategy of focusing on those SRMs that cannot be produced by secondary laboratories and which have broad and/or high downstream impact. In establishing its out-year projections, the NIST SRM Program monitors, among other things, trends in emerging technologies, new regulations that will depend on SRMs for enforcement, and the reference material needs of other federal agencies. Several microeconomic studies of NIST SRM programs have shown the technology transfer mechanisms built into these efforts to be effective with resulting high economic benefits delivered to industry.

- **Calibration Services**

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

  Over the past several years, NIST has calibrated approximately 3,000 items annually. Over the next several years, NIST expects to realize a relatively high but slightly declining number of items calibrated. This is in keeping with a long-term trend, over the past several decades, of a decline in the number of items calibrated by NIST. Despite this overall trend, individual years may fluctuate slightly due to multi-year calibration cycles. NIST expects to provide fewer but more highly leveraged calibration services over time. NIST's strategy is driven by the need to effectively manage trends in demand from its major industry and government customers for these services. NIST is pursuing three strategies: (1) performing only those calibrations that require a direct connection to the national standards; (2) improving calibration accuracy in those areas where new industry demands are emerging; and (3) accrediting primary and secondary calibration laboratories to meet on-going industry needs. Through this overall approach, NIST can efficiently leverage its primary calibration services to support a broader base of secondary calibrations conducted within the private sector. Several microeconomic studies of NIST calibration programs have shown the technology transfer mechanisms built into these efforts to be effective with resulting high economic benefits delivered to industry.

- **Standard Reference Data**

  NIST produces and makes available (i.e., sells or distributes for free) many Standard

Reference Data titles (SRDs). SRDs provide numeric data to scientists and engineers for use in technical problem solving, research, and development. These recommended values are based on data extracted from scientific and technical literature or on measurements done at NIST laboratories, which are then assessed for reliability and evaluated to select the preferred values. 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. Each year, however, some database titles are eliminated from the NIST catalog. Over time, 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 these titles will be distributed via the Internet. Several microeconomic studies of NIST SRD programs have shown the technology transfer mechanisms built into these efforts to be effective with resulting high economic benefits delivered to industry.

- **Technical Publications**

NIST uses publications as a key mechanism to transfer the results of its work to the U.S. private sector and to other government agencies that need cutting-edge measurements and standards. Many of these publications appear in prestigious scientific journals and withstand peer review by the scientific community. Others appear in technological forums where measurement standards and technologies developed by NIST staff (at times in collaboration with private sector partners) are disseminated. Of the technical publications produced annually, approximately 80% are approved for external publication (such as in scientific journals), while the remaining 20% are NIST reports and special publications.

Over time, NIST expects a relatively constant level of high quality publications (2,000-2,300 per year) to be produced by its technical staff.

- **Guest Researchers and Facilities Users**

Each year hundreds of researchers visit NIST to participate in collaborative projects and/or to use NIST's research facilities. NIST makes its facilities available for limited periods of time to domestic and foreign guest researchers to collaborate with NIST staff on research and development projects of mutual interest or to transfer NIST techniques, procedures, and best practices. NIST also sponsors several formal collaboration programs with universities, among them JILA, an interdisciplinary institute for research and graduate education in the physical sciences, located on the main campus of the University of Colorado (CU) in Boulder, and operated jointly by CU and NIST; and the Center for Advanced Research in Biotechnology (CARB). CARB conducts research and provides interdisciplinary training in fundamental problems at the forefront of biotechnology through collaborations with scientists at its parent institutions, the University of Maryland Biotechnology Institute and NIST.

- **Conferences, Workshops, and Inquiries**

  NIST also transfers technology through the hosting of numerous conferences and workshops, as well as through answering inquiries. In FY 2002, NIST Public and Business Affairs handled about 10,000 inquiries. In addition, during FY 2002, this office managed 120 conferences at the NIST sites in Gaithersburg and Boulder.

- **Participation in Documentary Standards Committees**

  Still another means by which NIST transfers technology is through staff participation in the activities of documentary standards committees, which develop consensus standards on a host of technologies. NIST participation enables NIST scientists and engineers to bring NIST technology directly into a standard, which could involve test methods and procedures for protecting health, safety, and/or the environment, or specifications for performance or interoperability, to name a few. During CY 02, a total of 440 NIST staff participated in 1426 activities of 968 standards committees, including 470 American Society for Testing and Materials (ASTM) committees, 93 American National Standards Institute (ANSI) committees, 53 Institute for Electrical and Electronic Engineers (IEEE), and 73 International Organization for Standardization (ISO) committees. 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.

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

NIST continues to evaluate the effectiveness of its mechanisms for technology transfer.

In the FY 2002 report, NIST has added new categories for non-traditional CRADA's to cover NIST calibration services, provide greater detail on licenses and license income, address workshops and conferences, and include participation by NIST staff in documentary standards committees.

The NIST Director has also asked the National Research Council Board on Assessment, as part of its annual assessment of the NIST laboratories, to examine the effectiveness of communication of its intellectual property policy to technical staff at all levels so that IP protection is sought when it is appropriate to do so.

2. Performance in FY 2002: Activities and Achievements

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

¦ Collaborative Relationships for Research & Development

	FY	FY	FY	FY
? CRADAs, total active in the FY[1]	261	208	174	1,812
- New, executed in the FY	62	40	22	1,712
? Traditional CRADAs,[2] total active in the FY	261	208	174	125*
- New, executed in the FY	62	40	22	25**
? Non-traditional CRADAs,[3] total active in the FY	--	--	0	1,687
- New, executed in the FY	--	--	0	1,687***
? Other types of collaborative R&D relationships				
? Facility use agreements, total in effect a end of FY[4]	--	--	372	391
-New, executed in the FY	--	--	172	62
? Guest scientists and engineers during the FY[5]	--	--	1,200****	1,300****

CRADA = Cooperative Research and Development Agreement. n/a = Data not available from agency at time of this report. -- = Data not requested from agency in previous years' reports.

(1) "Active" = legally in force at any time during the FY. "Total active" is comprehensive of all agreements executed under CRADA authority (15 USC 3710a).
(2) CRADAs involving collaborative research and development by a federal laboratory and non-federal partners.
(3) CRADAs used for special purposes -- such as, material transfer or technical assistance that may result in protected information.
(3) 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.
(4) "Guest scientists and engineers" includes foreign and domestic guest researchers, and researchers working at NIST under Intergovernmental Personnel Act (IPA) Agreements and CRADAs.

*Includes CRADA's associated with all NIST programs, including Manufacturing Extension Partnership (MEP), Technology Services (TS), and the Director of Administration/Chief Financial Officer (DA/CFO).
** Includes 3 new CRADAs in the MEP program.
*** 1,687 "non-traditional" CRADAs were issued in FY 2002 to protect the results (under CRADA authority) of 2,924 calibrated items from disclosure for a period of five years after development.
**** Figures are approximate.

¦ Invention Disclosure and Patenting

	FY	FY	FY	FY
? New inventions disclosed in the FY[(1)]	35	32	24	16
? Patent applications filed in the FY[(2)]	27	18	9	11
? Patents issued in the FY	26	14	20	15
? Active patents, end of the FY	--	--	--	199
? Patents purposely dropped (triaged) during the FY	--	--	--	34

-- = Data not requested from agency in previous years' reports.

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

¦ Licensing

Profile of Active Licenses

	FY	FY	FY	FY
? All licenses, number total active in the FY[(1)]	40	39	36	35
? New, executed in the FY	7	3	4	2
? Invention licenses, total active in the FY	40	39	36	35
? New, executed in the FY	7	3	4	2
- Patent (and patent application) licenses, total active in FY	40	39	36	35
? New, executed in the FY	7	3	4	2
- Material transfer licenses (inventions), total active in FY	0	0	0	0
? New, executed in the FY	0	0	0	0
- Other invention licenses, total active in the FY	0	0	0	0
? New, executed in the FY	0	0	0	0
? Other IP licenses, total active in the FY	0	0	0	0
? New, executed in the FY	0	0	0	0
- Copyright licenses (fee bearing)				
? New, executed in the FY				
- Material transfer licenses (non-inventions), total active in the FY				
? New, executed in the FY				

	FY 1999	FY 2000	FY 2001	FY 2002
- Other				
? New, executed in the FY				

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

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

Profile of Active Licenses (cont.)

	FY 1999	FY 2000	FY 2001	FY 2002
? Licenses which are income bearing, total number	18	16	19	33
? Number exclusive/partially-exclusive/non-exclusive	n/a	n/a	12/5/2	18/2/13
? Invention licenses which are income bearing	18	16	19	33
? Number exclusive/partially-exclusive/non-exclusive	n/a	n/a	12/5/2	18/2/13
- Patent (and patent application) licenses	18	16	19	33
? Number exclusive/partially-exclusive/non-exclusive	n/a	n/a	12/5/2	18/2/13
? Other IP licenses which are income bearing	0	0	0	0
? Number exclusive/partially-exclusive/non-exclusive				
- Copyright licenses (fee bearing)				
? Number exclusive/partially-exclusive/non-exclusive				
? Licenses which are royalty bearing, total number	18	16	19	33*
? Invention licenses which are royalty bearing	18	16	19	33
- Patent (and patent application) licenses	18	16	19	33
? Other IP licenses which are royalty bearing	0	0	0	0
- Copyright licenses (fee bearing)				

*Of the 35 active licenses in FY 2002 (see the previous table above), two are royalty-free research licenses.

Licensing Management

	FY 1999	FY 2000	FY 2001	FY 2002
? Elapsed execution time,(1) licenses granted in the FY				
? Invention licenses				
? average (or median) / min-max (months)	--	--	4.75 / 2-5	5.4 / 2.5-5
- Patent (and patent application) licenses				
? average (or median) / min-max (months)	--	--	4.75 / 2-5	5.4 / 2.5-5

	FY 1999	FY 2000	FY 2001	FY 2002
? Number of licenses terminated for cause in the FY				
? Invention licenses	--	--	7	3
- Patent (and patent application) licenses	--	--	7	3*

-- = Data not requested from agency in previous years' reports.

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

*In addition to the cited 3 licenses terminated "for cause" in FY 2002, 4 licenses were terminated by mutual agreement and 4 expired with the end of their original term.

License Income

	FY 1999	FY 2000	FY 2001	FY 2002
? Total income received, all licenses active in the FY [1]	$394,387	$122,575	$261,968	$89,750
? Invention licenses	$394,387	$122,575	$261,968	$89,750
- Patent (and patent application) licenses	$394,387	$122,575	$261,968	$89,750
? Other IP licenses, total active in the FY	0	0	0	0
- Copyright licenses				
? Total Earned Royalty Income (ERI) [2]	$394,387	$122,575	$261,968	$89,750
? Median ERI	--	--	n/a	$2,300
? Minimum, Maximum ERI	--	--	$1,000-135,927	$700-20,000
? ERI from top 1% of licenses	--	--	n/a	$20,000
? ERI from top 5% of licenses	--	--	n/a	$20,000
? ERI from top 20% of licenses	--	--	n/a	$50,000
? Invention licenses	$394,387	$122,575	$261,968	$89,750
? Median ERI	--	--	n/a	$2,300
? Minimum, Maximum ERI	--	--	$1,000-135,927	$700-20,000
? ERI from top 1% of licenses	--	--	n/a	$20,000
? ERI from top 5% of licenses	--	--	n/a	$20,000
? ERI from top 20% of licenses	--	--	n/a	$50,000
- Patent (and patent application) licenses	$394,387	$122,575	$261,968	$89,750
? Median ERI	--	--	n/a	$2,300
? Minimum, Maximum ERI	--	--	$1,000-135,927	$700-20,000
? ERI from top 1% of licenses	--	--	n/a	$20,000
? ERI from top 5% of licenses	--	--	n/a	$20,000

	FY 1999	FY 2000	FY 2001	FY 2002
? ERI from top 20% of licenses	--	--	n/a	$50,000
? Other IP licenses, total active in the FY	0	0	0	0
? Median ERI				
? Minimum, Maximum ERI				
? ERI from top 1% of licenses				
? ERI from top 5% of licenses				
? ERI from top 20% of licenses				
- Copyright licenses				
? Median ERI				
? Minimum, Maximum ERI				
? ERI from top 1% of licenses				
? ERI from top 5% of licenses				
? ERI from top 20% of licenses				

n/a = Data not available from agency at time of this report. -- = Data not requested from agency in previous years' reports.

(1) Total income includes license issue fees, earned royalties, minimum annual royalties, paid-up license fees, and reimbursement for full-cost recovery of goods and services provided by the lab to the licensee including patent costs.
(2) "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 1999	FY 2000	FY 2001	FY 2002
? Income distributed[1]				
? Invention licenses, total distributed	$394,387	$122,575	$261,968	$89,750
- To inventor(s)	$142,262 (36%)	$57,423 (47%)	$102,040 (39%)	$45,650 (51%)
- To other[2]	$252,125 (64%)	$65,152 (53%)	$159,928 (61%)	$44,100 (49%)
- Patent (and patent app.) licenses, total distributed	$394,387	$122,575	$261,968	$89,750
- To inventor(s)	$142,262 (36%)	$57,423 (47%)	$102,040 (39%)	$45,650 (51%)
-To other[2]	$252,125 (64%)	$65,152 (53%)	$159,928 (61%)	$44,100 (49%)

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

¦ Other Performance Measures Deemed Important by the Agency

Other Important Mechanisms for Technology and Knowledge Transfer[1]

	FY 1999	FY 2000	FY 2001	FY 2002
Standard Reference Materials (SRMs) available[2]	1,288	1,292	1,335	1,353
Standard Reference Materials (SRMs) sold[3]	33,347	34,020	31,985	30,996
Standard Reference Data (SRD) titles available[4]	60	63	65	90
Number of items calibrated[5]	3,118	2,969	3,192	2,924*
Technical publications produced[6]	2,270	2,250	2,207	2,236

(1) See Section 1 above for additional information about the measures listed here. See also the Department of Commerce's annual submissions under the Government Performance and Results Act (GPRA) for detailed information about each of these measures, analysis of trends, and future-year performance projections (http://www.osec.doc.gov/bmi/budget/02APPR/02ta.pdf).

(2) 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.

(3) Direct and verifiable count of NIST SRM units sold during the fiscal year.

(4) 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 70% are available for sale, and 30% are free online systems. Over time, a larger percentage of SRDs will be distributed via the Internet.

(5) Direct and verifiable count of items calibrated by the NIST laboratories. Over the next several years, NIST expects to realize a relatively high but slightly declining number of items calibrated. This is in keeping with a long-term trend, over the past several decades, of a decline in the number of items calibrated by NIST. NIST expects to provide fewer but more highly leveraged calibration services over time.

(6) Annual number of technical publications generated by NIST's technical staff. The number is a direct count of the number of technical publications cleared for publication by the NIST Editorial Review Boards at the Gaithersburg and Boulder sites. Over time, NIST expects a relatively constant level of high quality publications (2,000-2,200 per year) produced by its technical staff. Of the publications produced annually, approx. 80% are approved for external publication (such as in scientific journals); the other 20% are NIST reports and special publications.

* These 2,924 calibrated items were covered by 1,687 "non-traditional" CRADAs that protect the results from disclosure.

¦ Outcomes from Technology Transfer

NIST develops and disseminates infrastructural technologies and services required by the U.S. private sector and other non-profit and government partners. The outputs of the NIST

laboratories provide a foundation for industry in all stages of commerce—research, development, testing, production, and marketing—and in turn enable socio-economic impacts, such as productivity gains, increased market access and efficiency, and improved quality of life. These impacts are long-term, accruing years after the original infrastructural technologies were developed by NIST (often in conjunction with industry partners).

The examples below show how NIST's various technology transfer mechanisms – here, CRADA's, Standard Reference Materials, joint research facilities, software, and documentary standards – have, over the long term, produced outcomes that significantly benefit consumers and improve the quality of life. Most of these examples are linked to the NIST 2010 Strategic Plan, which identified five strategic focus areas: measurements and standards essential to established industries; health care quality assurance; nanoscale measurements and data; information and knowledge management; and measurements and standards for Homeland Security.

· **Nobel Prize awarded to NIST researcher.** Eric A. Cornell of NIST and Carl E. Wieman of the University of Colorado (CU) at Boulder led a team of physicists in a research effort that culminated in 1995 with the creation of the world's first Bose-Einstein condensate (BEC) —a new form of matter. The work, conducted at JILA, which is a joint research institute of NIST and CU-Boulder, earned them, along with Wolfgang Ketterle, a researcher at the Massachusetts Institute of Technology who did early studies on the properties of the BEC, the 2001 Nobel Prize in physics.

Predicted in 1924 by Albert Einstein, who built on the work of Satyendra Nath Bose, the Bose Einstein condensation occurs when individual atoms meld into a "superatom" behaving as a single entity at just a few hundred billionths of a degree above absolute zero. The 71-year quest to confirm Bose and Einstein's theory was likened by many physicists to the search for the mythical Holy Grail. The BEC allows scientists to study the strange and extremely small world of quantum physics as if they are looking through a giant magnifying glass. Its creation established a new branch of atomic physics that has proven to be a treasure-trove of scientific discoveries. Future applications of the BEC include its use in nanotechnology and precision measurement. Cornell is the second Nobel laureate for NIST. William Phillips, a NIST fellow, shared the 1997 Nobel Prize in physics.

· **Cooperative efforts led to new device to study weathering.** NIST researchers, in collaboration with industry and government partners, developed a revolutionary device to determine quickly and accurately the damage to polymer coatings, materials and structures from exposure to the sun's ultraviolet (UV) rays, temperature and humidity. The National Association of Home Builders estimates that Americans spend between $65 billion and $75 billion annually on maintenance, repair and replacement, often due to the premature failure of a material exposed to outdoor weathering. The new device, the NIST SPHERE, developed as the result of a CRADA with industry and government partners, will speed the introduction of new products into the market and reduce building repair costs, by avoiding the need for multiyear exposure to outdoor or simulated indoor weathering. The device accelerates weathering by generating controlled temperature, humidity and UV exposure environments up to 50 times faster than outdoor weathering, and allows rapid testing of the same material under a wide variety of

weathering environments at the same time. Using the NIST SPHERE will enable manufacturers to rapidly develop innovative products tailored for specific environments and will enable consumers to choose products based not only on cost but also on performance life.

· **Reference sample chip carrier.** To keep pace with competitive demands, the semiconductor industry has turned to larger wafers and high volume manufacturing tools, including automated material handling equipment now indispensable for processing the largest 300mm wafers. In order to calibrate these state-of-the-art tools, reference samples, in the form of standard chips, must be integrated onto a wafer to be compatible with the equipment. To avoid the high cost and inefficiency of processing an entire wafer to produce a single reference sample, NIST researchers designed and developed a reference sample chip carrier (RSCC) that allows reference samples to be manufactured in quantity on a single wafer, but then separated and mounted into this novel carrier to be compatible with automated wafer handling equipment. To facilitate technology transfer, NIST (1) established a consortium of 17 integrated circuit wafer manufacturers and tool suppliers involved in the development of single-crystal critical dimension reference materials to establish technical requirements; (2) partnered with Sandia National Laboratories to prototype the system; and (3) collaborated with a private enterprise now commercializing the technology. At present, RSCC technology has been deployed in some form at all major semiconductor fabrication facilities around the world.

· **Glass SRM for identification of chemical substances.** The capability to identify chemical substances easily and accurately at a crime scene or other location outside a laboratory, without handling the material or opening containers, would be a boon for many in science. A new NIST standard that reduces calibration costs as much as 20-fold represents a major step toward making such a tool practical. A small piece of chromium-doped glass, Standard Reference Material (SRM) 2241, will enable users to calibrate the output of Raman spectrometers. Without this SRM, full calibration of these instruments is so expensive that many users skip it and, therefore, may get inaccurate results. Raman spectroscopy reveals the chemical composition of a sample by illuminating it with a laser and then identifying color changes in a very small amount of the scattered light. The technique is simple enough to use in the field and, unlike some competing methods, can be used to measure samples through transparent containers.

· **Irradiation applications for bioterror mitigation.** In late October 2001, terrorism reached every home and workplace in the United States, as it became clear that the lives being lost due to anthrax in the mail, and the mundane task of opening the daily mail became life threatening. Even more threatened were the 700,000 postal workers who were required to handle large volumes of mail. To re-establish public trust in the U.S. Postal Service (USPS), as well as protect the workers that support it, the President's science advisors asked NIST to develop new irradiation technologies that would allow the USPS workers to resume their services to the U.S. public safely. Since NIST maintains and disseminates the national standards for radiation measurements, it was in a unique position to provide authoritative guidance on electron and x-ray technologies for mail irradiation.

With more than two million articles of contaminated mail of all types, the task of irradiating the mail was daunting. Working as a technical coordinator between the USPS and several industrial

radiation-processors, NIST assessed available industrial capabilities and defined postal sorting, handling, and processing guidelines that were optimized for the throughput, quality and effectiveness demands of the USPS. NIST experts designed and performed test experiments to validate the technology. NIST was also part of an industry-government team that wrote a documentary standard for mail-irradiation process control. From concept to completion, more than two million pieces of mail were sanitized in seven months. NIST continues to play a role in the on-going operation of this technology with more than sixty million pieces of mail sanitized as an ongoing preventative measure against unexpected attacks on members of the White House, Congress and the few hundred thousand Federal government employees that work in Washington D.C. NIST is currently adapting the radiation-processing technology to the needs of other federal agencies with a role in homeland security.

· **NIST airflow software featured in smoke management guide.** Being able to simulate how pollutants, smoke and contaminants are transported throughout a building and predict the effects that building design changes will have on airflow is becoming increasingly important to building designers and operators. Software known as CONTAM, developed several years ago by NIST researchers, can do just that. Now, CONTAM is featured in a new version of Principles of Smoke Management, a widely used publication issued by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE). The ASHRAE publication explains how CONTAM can be used to design and analyze smoke control systems in applications including elevator shafts, stairwells and exhaust systems. In addition to CONTAM's traditional application to the design or renovation of buildings, the software took on an unexpected role in the fall of 2001 when NIST engineers used it to understand how anthrax spores may have spread throughout the Hart Senate Office Building in Washington, D.C. The results of the modeling aided the development of decontamination strategies for the structure.

· **Study finds NIST gas standards yield substantial benefits**. Accurate, real-time monitoring of polluting gases emitted by electric utilities, automobiles and other sources depends heavily on equipment calibration standards made by or traceable to NIST. A new study now available from NIST, *The Economic Impact of the Gas-Mixture NIST-Traceable Reference Materials Program* (NIST Planning Report 02-4), found that the gas-mixture NIST-Traceable Reference Materials (NTRM) program, an innovative mechanism for meeting a high demand for standards, returns between $21 and $27 in benefits for every dollar spent, with substantial benefits extending into the future.

The NTRM program was created in the early 1990s by NIST, the U.S. Environmental Protection Agency (EPA), and specialty gas companies to increase the availability of NIST-certified reference materials needed to monitor compliance with environmental regulations. Most EPA regulations for stationary source, mobile source and ambient air monitoring require that measurements be traceable to NIST. Under the program, gas companies manufacture standards according to NIST technical specifications and submit these mixtures to NIST for certification. In addition to greatly increasing the supply of gas-mixture standards, the NTRM program, after an initial start-up investment by NIST, minimizes on-going costs to taxpayers because industry fees now support it. According to the study, benefits of the program include reduced measurement uncertainty, helping users of the reference materials to avoid some operations and

maintenance costs and reducing credit expenditures in emissions trading (an innovative approach to environmental regulation that is generally believed to reduce total pollution-abatement costs).

· **NIST study shows industries taking a big STEP to savings.** A number of U.S. industries already are saving millions of dollars a year, and could save a total of more than $900 million annually, by using a suite of international standards that reduce interoperability problems encountered in the exchange of digital product information. A NIST study assessed the economic impact of the **ST**andard for **E**xchange of **P**roduct model data (STEP, formally known as ISO 10303), which provides a neutral format that enables the exchange of data between proprietary systems. Some parts of STEP already are international standards, and other parts are still in development. The study also evaluated NIST's contributions to the development, testing and implementation of STEP. Data from industry surveys and case studies were used to estimate that, within the industries studied, full implementation of STEP could save $928 million (in 2001 dollars) per year. More than half of the projected savings would be realized in the automotive and aerospace industries—which have been leaders in STEP development and implementation —with the remainder going to the aerospace, shipbuilding, and the tool and die industries.

Many other industries worldwide could achieve similar savings. To date, STEP has been partially implemented, with approximately 17 percent ($156 million per year) of the potential benefits realized in the industries studied. Much of the savings is due to the avoidance of labor costs associated with the use and support of redundant software applications. The study found that NIST's administrative and technical activities accelerated the development and adoption of STEP, yielding a net present value economic impact of $180 million (in 2001 dollars) which translates into a benefit-to-cost ratio of almost 8 to 1 and a social (internal) rate of return of 62 percent. These figures reflect only part of NIST's contributions, which also enhanced the quality and reduced the costs of STEP development and deployment.

III. NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Technology Transfer at the Agency's Federal Laboratories – Approach and Plans, FY 2002 Activities/Achievements

1. Agency Approach and Plans for Technology Transfer

The mission of the National Oceanic and Atmospheric Administration (NOAA) is to understand and predict changes in the Earth's environment and conserve and manage marine resources to meet the Nation's economic, social, and environmental needs. NOAA's primary mechanism for technology transfer has historically been the open dissemination of scientific information to the public, industry, government, and universities. This means of technology transfer is consistent with the agency's mission and has been found to be more efficient and economical than transfer through patenting and licensing. Also, NOAA scientists have found that the time and expense required to set-up Cooperative Research and Development Agreements (CRADAs) often outweigh their advantages. Consequently, NOAA's technology transfer program should not be measured solely in terms of CRADAs, patents, and licenses. Rather, it should be viewed in terms of meeting the primary agency mission and its benefits to the public. An example of beneficial information disseminated to the public is the daily weather forecast.

In FY 2002, NOAA carried out an extensive technology transfer program by not only providing weather forecasts and warnings but also by applying numerous environmental technologies directly to the public, industry, government, and universities.

The NOAA web page at www.noaa.gov details the voluminous amount of technology made available to all in the form of data and information products and services, such as weather and climate data, climate forecasts, predictions of El Nino and local tides and currents, satellite imagery, fishery statistics, and information on protected species, air quality, real time coastal information, nautical charts, as well as extensive data bases on the oceans, geophysics, and the sun.

In future years, NOAA will continue to carry out its considerable technology transfer activities, while working towards four mission goals: 1. Protect, restore, and manage the use of coastal and ocean resources through ecosystem management approaches; 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; 4. Support the Nation's commerce with information for safe and efficient transportation.

To advance the agency's mission and benefit the competitiveness of U.S. industry, NOAA will continue to facilitate the transfer of intellectual property to industry through licenses, CRADAs, and by direct transfer. As stated in the NOAA Administrative Order 201-103, "It is NOAA's policy that laboratory directors and research managers at all levels seek opportunities for collaborative research when such collaboration could lead to commercial exploitation of research results and contribute to NOAA's mission. It is also NOAA policy that laboratory directors encourage their employees to promote commercial development on their innovations."

However, historically there has been little interest in marketing NOAA inventions because they seldom have any significant commercial appeal. Declining resources and the increasing costs of obtaining patents have become major obstacles to patenting NOAA technologies. NOAA scientist will continue to strive to secure Intellectual Property rights for innovations with commercial promise. Their success will be, in part, dependent on the individual's laboratory ability to provide the necessary resources.

NOAA's Office of Research and Technology Applications (ORTA), which functions as the agency Technology Transfer clearing house, has recently hired a full time employee to work on Technology Transfer. In FY 2003, ORTA plans to create a Web site to help educate and encourage NOAA scientists to develop patents, licenses and CRADAs for their innovations as well as keeping scientists informed on NOAA's progress in these areas. In addition, ORTA plans to brief the Laboratory scientists on technology transfer responsibilities and discuss alternatives for funding their technology transfer activities.

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

NOAA conducts its technology transfer through activities (as described above) beyond the "traditional" mechanisms of holding patents, engaging in licensing, and participating in CRADAs. NOAA is presently in the process of developing techniques to measure the effects of these capabilities and technologies for our customers; we expect to have such data available for our annual report next year.

2. Performance in FY 2002: Activities and Achievements

¦ Collaborative Relationships for Research & Development

? CRADAs, total active in the FY[1]	8	10	8	8
- New, executed in the FY	1	3	3	1
? Traditional CRADAs,[2] total active in the FY	8	10	8	8
- New, executed in the FY	1	3	3	1
? Non-traditional CRADAs,[3] total active in the FY	0	0	0	0
- New, executed in the FY	0	0	0	0
? Other types of collaborative R&D relationships	0	0	0	0

CRADA = Cooperative Research and Development Agreement.

(1) "Active" = legally in force at any time during the FY. "Total active" is comprehensive of all agreements executed under CRADA authority (15 USC 3710a).
(2) CRADAs involving collaborative research and development by a federal laboratory and non-federal partners.
(3) CRADAs used for special purposes -- such as, material transfer or technical assistance that may result in protected information.

¦ Invention Disclosure and Patenting

	FY 1999	**FY 2000**	**FY 2001**	**FY 2002**
? New inventions disclosed in the FY[1]	3	2	1	1
? Patent applications filed in the FY[2]	2	2	3	0
? Patents issued in the FY	2	2	1	5

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

Licensing

Profile of Active Licenses

	FY 1999	FY 2000	FY 2001	FY 2002
? All licenses, number total active in the FY(1)	0	0	1	2
? New, executed in the FY	0	0	1	1
? Invention licenses, total active in the FY	0	0	1	2
? New, executed in the FY	0	0	1	1
- Patent (and patent application) licenses, total active in FY	0	0	1	2
? New, executed in the FY	0	0	1	1
- Material transfer licenses (inventions), total active in FY	0	0	0	0
? New, executed in the FY	0	0	0	0
- Other invention licenses, total active in the FY	0	0	0	0
? New, executed in the FY	0	0	0	0
? Other IP licenses, total active in the FY	0	0	0	0
? New, executed in the FY	0	0	0	0
- Copyright licenses (fee bearing)				
? New, executed in the FY				
- Material transfer licenses (non-inventions), total active in the FY				
? New, executed in the FY				
- Other				
? New, executed in the FY				

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

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

Profile of Active Licenses (cont.)

	FY 1999	FY 2000	FY 2001	FY 2002
? Licenses which are income bearing, total number	0	0	1	2
? Number exclusive/partially-exclusive/non-exclusive	--	--	1/0/0	1/0/1
? Invention licenses which are income bearing	0	0	1	2
? Number exclusive/partially-exclusive/non-exclusive	--	--	1/0/0	1/0/1
- Patent (and patent application) licenses	0	0	1	2
? Number exclusive/partially-exclusive/non-exclusive	--	--	1/0/0	1/0/1
? Other IP licenses which are income bearing	0	0	0	0
? Number exclusive/partially-exclusive/non-exclusive				
- Copyright licenses (fee bearing)				

	FY 1999	FY 2000	FY 2001	FY 2002
? Number exclusive/partially-exclusive/non-exclusive				
? Licenses which are royalty bearing, total number	0	0	1	2
? Invention licenses which are royalty bearing	0	0	1	2
- Patent (and patent application) licenses	0	0	1	2
? Other IP licenses which are royalty bearing	0	0	0	0
- Copyright licenses (fee bearing)				

-- = Data not requested from agency in previous years' reports.

Licensing Management

	FY 1999	FY 2000	FY 2001	FY 2002
? Elapsed execution time,(1) licenses granted in the FY				
? Invention licenses				
? average (or median) / min-max (months)	*	*	8**	8**
- Patent (and patent application) licenses				
? average (or median) / min-max (months)	*	*	8**	8**
? Number of licenses terminated for cause in the FY				
? Invention licenses	0	0	0	0
- Patent (and patent application) licenses	0	0	0	0

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

*No new licenses were executed in FYs 1999 and 2000.
** In FY 2001 and 2002, only a single license was executed. Thus, there is no min-max range for elapsed execution time to report.

License Income

	FY 1999	FY 2000	FY 2001	FY 2002
? Total income received, all licenses active in the FY (1)	0	0	$1,500	$7,969
? Invention licenses	0	0	$1,500	$7,969
- Patent (and patent application) licenses			$1,500	$7,969
? Other IP licenses, total active in the FY			0	0
- Copyright licenses				
? Total Earned Royalty Income (ERI) (2)	0	0	$1,500	$7,969

	FY 1999	FY 2000	FY 2001	FY 2002
? Median ERI				
? Minimum, Maximum ERI				
? ERI from top 1% of licenses				
? ERI from top 5% of licenses				
? ERI from top 20% of licenses				
? Invention licenses	0	0	$1,500	$7,969
? Median ERI				
? Minimum, Maximum ERI				
? ERI from top 1% of licenses				
? ERI from top 5% of licenses				
? ERI from top 20% of licenses				
- Patent (and patent application) licenses	0	0	$1,500*	$7,969*
? Median ERI				
? Minimum, Maximum ERI				
? ERI from top 1% of licenses				
? ERI from top 5% of licenses				
? ERI from top 20% of licenses				
? Other IP licenses, total active in the FY	0	0	0	0
? Median ERI				
? Minimum, Maximum ERI				
? ERI from top 1% of licenses				
? ERI from top 5% of licenses				
? ERI from top 20% of licenses				
- Copyright licenses				
? Median ERI				
? Minimum, Maximum ERI				
? ERI from top 1% of licenses				
? ERI from top 5% of licenses				
? ERI from top 20% of licenses				

(1) Total income includes license issue fees, earned royalties, minimum annual royalties, paid-up license fees, and reimbursement for full-cost recovery of goods and services provided by the lab to the licensee including patent costs.
(2) "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.

*In FY 2001 and 2002, there was only one license receiving income. Thus, there are no distributional statistics on Earned Royalty Income to report for either of these years.

Disposition of License Income

	FY 1999	FY 2000	FY 2001	FY 2002
? Income distributed [1]				
? Invention licenses, total distributed	0	0	$1,500	$7,969
- To inventor(s)	0	0	$1,500 (100%)	$7,969 (100%)
- To other	0	0	0 (0%)	0 (0%)
- Patent (and patent application) licenses, total distributed	0	0	$1,500	$7,969
- To inventor(s)	0	0	$1,500 (100%)	$7,969 (100%)
-To other	0	0	0 (0%)	0 (0%)

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

¦ Other Performance Measures Deemed Important by the Agency

None cited in this year's report.

¦ Outcomes from Technology Transfer

· **Receptor technologies for harmful algal bloom toxins.** NOAA scientists developed receptor-based assays for each class of algal toxin found in U.S. coastal waters: domoic acid-the amnesic shellfish poison (ASP), saxitoxin-the paralytic shellfish poison (PSP), brevetoxin-the neurotoxic shellfish poison (NSP), and ciguatoxin-the ciguatera fish poison (CFP). The method was directly transferred and training provided to the EPA Gulf Breeze Laboratory, NMFS Northwest Fisheries Center, Florida Marine Research Institute, California Department of Health Services, University of California at Santa Cruz, and Maine Department of Marine Resources. The economic loses due to harmful algal blooms average $19 million per year in commercial fisheries, while the costs to public health in the U.S. averages $22 million per year. International trade has been facilitated by receptor technology projects with eleven southeast Asian countries and with countries in South America and Africa.

· **Verification system to improve aviation forecasts**. Real-Time verification system technology was transferred into operations at the National Weather Service Aviation Weather Center from NOAA's Forecast Systems Laboratory. NOAA scientists working with the FAA and the National Center for Atmospheric Research developed an interactive, easy-to-use Web-based verification system (http://wwwad.fsl.noaa.gov/afra/rtvs), which consistently, independently, and in near real time computes statistical results for aviation forecasts. Now, before a forecast of in-flight icing, turbulence, or convective weather is approved, its output can be objectively compared with every pilot report, every radar image, or every other observation taken. This can

be done for a day, a week, or for any short period over any user-defined geographic area. The system has also been directly transferred to multiple research teams in multiple organizations, not only to users in the Government but also to private sector users, such as the National Business Aviation Association, Inc.

· **Real-time radar data archival and internet delivery system**. The NOAA developed CRAFT (Collaborative Radar Acquisition Field Test) provides relatively inexpensive, real-time access to high-resolution radar data for government, university, and private sector use in support of critical decision making applications such as those used in forecasting severe weather and floods. Abeliene, the Country's high-speed research network, is providing free, state-of-the-science network bandwidth. Through this network, CRAFT is delivering high quality radar data to a geographically diverse group of users. Also. the University of Oklahoma, NOAA's primary collaborator, has developed a distribution center to directly transfer high-resolution radar data that is being used by private companies like Baron Services, Weather Data, and Weather Decision Technologies. They are developing high resolution forecast products for their clients. In a spinoff project, NOAA is developing a hydrologic decision support system to help forecast and mitigate the effects of hurricanes and tropical storms. NOAA is working to directly transfer this system to several foreign governments.

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

Technology Transfer at the Agency's Federal Laboratories – Approach and Plans, FY 2002 Activities/Achievements

I. Agency Approach and Plans for Technology Transfer

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

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

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

Cooperative research and development. Cooperative research and development agreements (CRADAs), based upon the Federal Technology Transfer Act (FTTA) of 1986, are a principal means through which ITS aids the private sector. The FTTA provides the legal basis for and encourages shared use of government facilities and resources with the private sector in advanced telecommunications technologies. These partnerships aid in the commercialization of new products and services; they also enhance the capabilities of ITS laboratories.

In FY 2002, 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) and local multipoint distribution service (LMDS) technologies have been achieved through CRADAs, which have aided U.S. efforts to rapidly introduce socially-beneficial new communications technologies. More recently, CRADAs in the areas of objective audio and video quality and advanced antennas

for wireless systems have allowed ITS to contribute to the development of new products and services.

In addition, ITS plans to continue using patents to secure intellectual property rights in laboratory innovations with commercial promise. ITS plans to advance its mission and benefit the competitiveness of U.S. industry by pursuing opportunities to commercially license patents to CRADA partners and other interested parties. As an example, ITS is targeting software implementing a video quality metric for commercial development. This software incorporates technology covered by two patents and one patent application owned by ITS. A beta version of the software will be made available on-line for testing purposes and to generate interest in licensing.

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

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

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 Telecommunications 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, and other telecommunication standards organizations, providing technical leadership that is trusted by the commercial sector participants. ITS' technical inputs are relied upon as technically advanced and sound, and unbiased by commercial interests.

In FY 2002, 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.

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

ITS' annual performance reporting this year has been revised somewhat, in line with the updated Department of Commerce guidelines of December 2002.

In addition, the *number of publications approved through the Editorial Review Board (ERB) process* has been added as a new metric in the "Other Performance Measures" category. While not perfect, this metric provides a useful, working measure of the number of quality publications released to the public.

Also, an effort is presently underway to identify metrics for ITS' technology transfer through telecommunication standards development activities. Possible metrics include the number of standards committee leadership positions, the number of documents submitted, and the number of standards adopted that include ITS technology. It is anticipated that a metric (or metrics) will be selected that is (are) both measurable and as well as possible reflects the value of ITS' standards activities. (ITS standards documents do not go through the ERB process.)

II. Performance in FY 2002: Activities and Achievements

¦ Collaborative Relationships for Research & Development

	FY 1999	FY 2000	FY 2001	FY 2002
? CRADAs, total active in the FY[1]	--	--	66	63
- New, executed in the FY	--	--	--	7
? Traditional CRADAs,[2] total active in the FY	6	3	6	6
- New, executed in the FY	4	3	1	0
? Non-traditional CRADAs,[3,4] total active in the FY	--	--	59	57
- New, executed in the FY	--	--	--	6
? Other types of collaborative R&D relationships				
Collaborative standards[5] contributions, total active in FY	--	--	3	3
-New, executed in the FY	--	--	3	0

CRADA = Cooperative Research and Development Agreement. -- = Data not requested from agency in previous years' reports.

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

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

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

(4) ITS' "Telecommunication 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. The use of CRADAs 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 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, through a number of standards fora, to apply research results to the development of telecommunication performance standards and guidelines. In FY 2002, ITS worked collaboratively with Sarnoff, Tektronix, and SBC, under the ANSI accredited committee T1A1, to produce a series of five technical reports for assessing the accuracy and cross-calibration of video quality metrics.

Benefits of collaborative research for lab performance. Cooperative research with private industry has helped ITS accomplish its mission to support industry's productivity and competitiveness by providing insight into industry needs. And this has led to adjustments in the focus and direction of other Institute programs to improve their effectiveness and value.

Invention Disclosure and Patenting

	FY 1999	FY 2000	FY 2001	FY 2002
? New inventions disclosed in the FY[1]	0	0	1	0
? Patent applications filed in the FY[2]	1	0	0	1
? Patents issued in the FY	0	2	0	0
? Active patents, end of the FY	3	5	5	5

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

Licensing

Profile of Active Licenses

	FY 1999	FY 2000	FY 2001	FY 2002
? All licenses, number total active in the FY[1]	1	2	2	3
? New, executed in the FY	0	1	0	2
? Invention licenses, total active in the FY	1	2	2	3
? New, executed in the FY	0	1	0	2
- Patent (and patent application) licenses, total active in FY	1	2	2	3
? New, executed in the FY	0	1	0	2
- Material transfer licenses (inventions), total active in FY	0	0	0	0
? New, executed in the FY	0	0	0	0
- Other invention licenses, total active in the FY	0	0	0	0
? New, executed in the FY	0	0	0	0
? Other IP licenses, total active in the FY	0	0	0	0
? New, executed in the FY				
- Copyright licenses (fee bearing)				
? New, executed in the FY				
- Material transfer licenses (non-inventions), total active in the FY				
? New, executed in the FY				
- Other				
? New, executed in the FY				

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

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

Profile of Active Licenses (cont.)

	FY 1999	FY 2000	FY 2001	FY 2002
? Licenses which are income bearing, total number	1	1	1	3
? Number exclusive/partially-exclusive/non-exclusive	0/0/1	0/0/1	0/0/1	0/0/3
? Invention licenses which are income bearing	1	1	1	3
? Number exclusive/partially-exclusive/non-exclusive	0/0/1	0/0/1	0/0/1	0/0/3
- Patent (and patent application) licenses	1	1	1	3
? Number exclusive/partially-exclusive/non-exclusive	0/0/1	0/0/1	0/0/1	0/0/3
? Other IP licenses which are income bearing	0	0	0	0
? Number exclusive/partially-exclusive/non-exclusive	--	--	--	0/0/0
- Copyright licenses (fee bearing)	0	0	0	0
? Number exclusive/partially-exclusive/non-exclusive	--	--	--	0/0/0
? Licenses which are royalty bearing, total number	1	1	1	0
? Invention licenses which are royalty bearing	1	1	1	0
- Patent (and patent application) licenses	1	1	1	0
? Other IP licenses which are royalty bearing	0	0	0	0
- Copyright licenses (fee bearing)	0	0	0	0

Licensing Management

	FY 1999	FY 2000	FY 2001	FY 2002
? Elapsed execution time,(1) licenses granted in the FY				
? Invention licenses				
? average (or median) / min-max (months)	*	6**	*	5**
- Patent (and patent application) licenses				
? average (or median) / min-max (months)	*	6**	*	5**
? Number of licenses terminated for cause in the FY				
? Invention licenses	0	0	0	0
- Patent (and patent application) licenses	0	0	0	0

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

*No new licenses were executed in FYs 1999 and 2001.
**In FY 2000 and 2002, only a single new license was executed. Thus, there is no min-max range for elapsed execution time to report.

License Income

	FY 1999	FY 2000	FY 2001	FY 2002
? Total income received, all licenses active in the FY [1]	$10,892	$63,693	$5,000	$65,470
? Invention licenses	$10,892	$63,693	$5,000	$65,470
- Patent (and patent application) licenses	$10,892	$63,693	$5,000	$65,470
? Other IP licenses, all active licenses in the FY	$0	$0	$0	$0
- Copyright licenses				
? Total Earned Royalty Income (ERI) [2]	$10,892	$63,693	$0	$0
? Median ERI				
? Minimum, Maximum ERI				
? ERI from top 1% of licenses				
? ERI from top 5% of licenses				
? ERI from top 20% of licenses				
? Invention licenses	$10,892	$63,693	$0	$0
? Median ERI				
? Minimum, Maximum ERI				
? ERI from top 1% of licenses				
? ERI from top 5% of licenses				
? ERI from top 20% of licenses				
- Patent (and patent application) licenses	$10,892*	$63,693*	$0	$0
? Median ERI				
? Minimum, Maximum ERI				
? ERI from top 1% of licenses				
? ERI from top 5% of licenses				
? ERI from top 20% of licenses				
? Other IP licenses, total active in the FY				
? Median ERI				
? Minimum, Maximum ERI				
? ERI from top 1% of licenses				
? ERI from top 5% of licenses				
? ERI from top 20% of licenses				
- Copyright licenses				
? Median ERI				
? Minimum, Maximum ERI				
? ERI from top 1% of licenses				

	FY 1999	FY 2000	FY 2001	FY 2002
? ERI from top 5% of licenses				
? ERI from top 20% of licenses				

(1) Total income includes license issue fees, earned royalties, minimum annual royalties, paid-up license fees, and reimbursement for full-cost recovery of goods and services provided by the lab to the licensee including patent costs.
(2) "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.

* In FYs 1999, 2000, 2001, there was only one active license. Thus, there are no distributional statistics on Earned Royalty Income to report for either of these years.

Disposition of License Income

	FY 1999	FY 2000	FY 2001	FY 2002
? Income distributed [1]				
? Invention licenses, total distributed	$10,982	$63,693	$5,000	$65,470
- To inventor(s)	$4,695 (43%)	$20,508 (32%)	$2,900 (58%)	$21,041 (32%)
- To other [2]	$6,287 (57%)	$43,185 (68%)	$2,100 (42%)	$44,429 (68%)
- Patent (and patent application) licenses, total distributed	$10,982	$63,693	$5,000	$65,470
- To inventor(s)	$4,695 (43%)	$20,508 (32%)	$2,900 (58%)	$21,041 (32%)
-To other [2]	$6,287 (57%)	$43,185 (68%)	$2,100 (42%)	$44,429 (68%)

(1) Income includes royalties and other payments received during the FY.
(2) ITS/NTIA

¦ Other Performance Measures Deemed Important by the Agency

Other Important Mechanisms for Technology and Knowledge Transfer[1]

	FY 1999	FY 2000	FY 2001	FY 2002
Technical publications produced	32	20	17	17

(1) See section 1 above for additional information about the measures listed here.

Outcomes from Technology Transfer

- **Comarco cellular test equipment.** Comarco, Inc. (a U.S. test equipment manufacturer), signed a patent license for the use of ITS' MNB speech quality estimation algorithm. Comarco based their Q-MOS algorithm on the ITS MNB algorithm and offered it for sale as an available software tool in several of the Comarco cellular test equipment product lines. This test equipment is used by major cell phone service providers to test, diagnose, and maintain their cellular radio systems.

- **Personal communication services** (PCS). Much of ITS' work in PCS, over several years, has been accomplished through CRADAs with partners such as U.S. West, Bell South, Telesis Technology Laboratory, and Motorola. Collaboration between ITS and Motorola was instrumental in Motorola receiving a license (valued at $100,000,000) to provide PCS in Hong Kong. PCS has now been commercialized worldwide, and new developments continue as PCS is extended to third generation PCS and beyond. ITS has continued this work in FY 2002 through a CRADA with Lucent Technologies' Bell Laboratories that is investigating multiple-input/multiple-output antenna arrays, a technology that is targeted to dramatically increase the capacity of wireless systems and, therefore, reduce the problem of spectrum crowding. This technology is 3 to 5 years from commercial application.

- **Local multipoint distribution services** (LMDS). ITS has been a premier laboratory in millimeter wave research for two decades. CRADAs with private industry have enabled ITS to apply this unique expertise while conducting research into radio propagation for LMDS. LMDS will provide broadband wireless communications for business and residential applications and is now being commercialized. Systems have been deployed in the U.S. and a number of U.S. companies are exporting systems and services. Research into LMDS has been conducted with CRADA partners such as Hewlett Packard, U.S. WEST, and Lucent Technologies.

Data derived from these CRADAs provided a foundation for domestic and international standards development and efficient allocation of radio frequency spectrum resources. To date, major contributions to PCS and LMDS technologies have been and will continue to be carried out under these CRADAs to aid U.S. efforts to rapidly introduce new communications technologies for the benefit of society.

- **Digital video communication research**. In FY 2002, ITS continued to perform research with two university CRADA partners (University of Pennsylvania and East Carolina University) that provided the laboratory access to Internet 2 capabilities and medical imaging, which would not have been otherwise available to the laboratory. Through these CRADAs, ITS continued related research in digital video communication performance, addressing such emerging and future applications as video telephony and teleconferencing, telemedicine, and interactive video distribution. The lab was also able to continue its development of multimedia test capabilities. These user-oriented test capabilities are extremely valuable in implementing and optimizing the national and international information infrastructure, including the Next Generation Internet (NGI).

- **Video quality assessment system**. A CRADA during FY 2002 was targeted at research relating to the development of a Windows-based video quality assessment system. The Windows-based system will provide a user friendly video quality assessment system that will be usable by anyone concerned with video quality, without the need for large computer systems. This CRADA provided the laboratory with a computer system for this development and software that was developed by the CRADA partner, greatly increasing the capabilities of the laboratory. The Windows-based video quality assessment system, that was developed under this CRADA, incorporates technology covered by two patents and one patent application owned by ITS/NTIA. It is targeted for commercial development, with the potential of producing a royalty income for the laboratory within one years.