SUPPLEMENTAL REPORT
Department of Commerce, Annual Budget Proposal, FY 2005

# Annual Report on Technology Transfer: Approach and Plans, FY 2003 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)

January 5, 2004

**Foreword**. This is the calendar year 2004 edition of a report series summarizing the technology transfer activities and achievements of the Department of Commerce's federal laboratories. This report responds to the statutory requirement for an annual "agency report on utilization" [15 U.S.C. Section 3710 (f)] under the revised federal-wide reporting process established by the Technology Transfer Commercialization Act of 2000 (P.L. 106-404). All federal agencies that direct one or more federal laboratories or conduct other activities under Section 207 and 209 of Title 35, United States Code are subject to the requirements of this statute.

At the Department of Commerce, technology transfer is a part of the mission and program activities of principally the National Institute of Standards and Technology (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 departmental 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 2003 and several earlier comparative years. The report begins with a summary of this information for the Department of Commerce as a whole.

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This report has been organized and prepared by the Office of Technology Policy (Technology Administration), along with the joint 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).

## Table of Contents

# *I. DEPARTMENT OF COMMERCE OVERVIEW*

## *Technology Transfer by the Department's Federal Laboratories – Summary of Approaches and FY 2003 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 agencies' federal lab systems.[1]

### Agency Missions and Main Channels for Technology Transfer

| Mission | Tech Transfer |
|---|---|
| **Technology Administration – National Institute of Standards and Technology**<br><br>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.<br><br>Principal tech tranfer mechanisms:<br>CRADAs,<br>Patents and licenses,<br>Technical publications,<br>Standard Reference Materials,<br>Standard Reference Data,<br>Calibration services,<br>Documentary standards<br>Conferences, workshops, and inquiries<br>Guest researchers and facilities users. |

[1] In reviewing the technology transfer plans and activity statistics provided, it is important to recognize there are significant differences among the three agencies in the level of resources available to support R&D activities. For NIST, budget authority for R&D (including conduct of R&D and R&D facilities) in FY 2003 totaled an estimated $527 million. For NOAA, the corresponding figure for R&D budget authority in FY 2003 is $684 million. For ITS, the corresponding FY 2003 figure is $6 million.

| Mission | Tech Transfer |
|---|---|
| | |
| **National Oceanic and Atmospheric Administration**<br><br>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.<br><br>Principal tech tranfer mechanisms:<br>Dissemination<br>CRADAs,<br>Patents and licenses |
| **National Telecommunications and Information Administration -- Institute for Telecommunication Sciences**<br><br>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.<br><br>Principal tech tranfer mechanisms:<br>CRADAs,<br>Patents and licenses,<br>Telecommunications analysis services. |

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

## ¦ Summary of Technology Transfer Activities and Achievements across the Department, FY 2003 and Several Recent Years

### *? Selected Activity Measures*

**Collaborative Relationships for Research & Development**

| | | FY 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|---|
| ? **CRADAs**, total active in the FY [1] | | | | | | |
| ? Traditional CRADAs [2] | Department | 275 | 221 | 188 | 139 | 92 |
| | NIST | 261 | 208 | 174 | 125 | 76 |
| | NOAA | 8 | 10 | 8 | 8 | 11 |
| | ITS | 6 | 3 | 6 | 6 | 5 |
| ? Non-traditional CRADAs [3] | Department | -- | -- | 59 | 1,744 | 1,811 |
| | NIST | 0 | 0 | 0 | 1,687 | 1,577 |
| | NOAA | 0 | 0 | 0 | 0 | 0 |
| | ITS | -- | -- | 59 | 57 | 234 |

| | | FY | FY | FY | FY | FY |
|---|---|---|---|---|---|---|
| | | | | | | |
| ? **Other types of collaborative R&D relationships** [4] | | | | | | |
| ? Facility use agreements | NIST | -- | -- | 372 | 391 | 512 |
| ? Guest scientists and engineers | NIST | -- | -- | 1,200 | 1,300 | 1,300 |
| ? Collaborative standards contributions | ITS | -- | -- | 3 | 3 | 2 |

CRADA = Cooperative Research and Development Agreement. -- = Data not requested from agencies in reports of earlier years.

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

## Invention Disclosure and Patenting

| | | FY | FY | FY | FY | FY |
|---|---|---|---|---|---|---|
| ? New inventions disclosed in the FY [1] | Department | 38 | 34 | 26 | 17 | 21 |
| | NIST | 35 | 32 | 24 | 16 | 16 |
| | NOAA | 3 | 2 | 1 | 1 | 5 |
| | ITS | 0 | 0 | 1 | 0 | 0 |
| ? Patent applications filed in the FY [2] | Department | 30 | 20 | 12 | 12 | 5 |
| | NIST | 27 | 18 | 9 | 11 | 5 |
| | NOAA | 2 | 2 | 3 | 0 | 0 |
| | ITS | 1 | 0 | 0 | 1 | 0 |
| ? Patents issued in the FY | Department | 28 | 18 | 21 | 20 | 9 |
| | NIST | 26 | 14 | 20 | 15 | 7 |
| | NOAA | 2 | 2 | 1 | 5 | 1 |
| | ITS | 0 | 2 | 0 | 0 | 1 |

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

**Licensing -- Profile of Active Licenses**

| | | FY 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|---|
| ? **All licenses**, number total active in FY [1] | Department | 43 | 43 | 40 | 41 | 101 |
| ?**Invention licenses**, total active in FY | Department | 43 | 43 | 40 | 41 | 101 |
| - Patent licenses [2] | Department | 43 | 43 | 40 | 41 | 101 |
| | NIST | 40 | 39 | 36 | 35 | 39 |
| | NOAA | 2 | 2 | 2 | 3 | 5 |
| | ITS | 1 | 2 | 2 | 3 | 57 |
| - Material transfer licenses (inventions) | | 0 | 0 | 0 | 0 | 0 |
| - Other invention licenses | | 0 | 0 | 0 | 0 | 0 |
| ?**Other IP licenses**, total active in FY | Department | 0 | 0 | 0 | 0 | 0 |
| - Copyright licenses (fee bearing) | | | | | | |
| - Material transfer licenses (non-inventions) | | | | | | |
| - Other | | | | | | |

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

(1) "Active" = legally in force at any time during the FY.
(2) Patent license tally includes patent applications which are licensed.

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 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|---|
| ? **All income bearing licenses**, number | Department | 20 | 18 | 22 | 39 | 37 |
| ?**Invention licenses**, income bearing | Department | 20 | 18 | 22 | 39 | 37 |
| - Patent licenses [1] | Department | 20 | 18 | 22 | 39 | 37 |
| | NIST | 18 | 16 | 19 | 33 | 29 |
| | NOAA | 1 | 1 | 2 | 3 | 5 |
| | ITS | 1 | 1 | 1 | 3 | 3 |
| ? Exclusive/partially exclusive/ non-exclusive | Department | -- | -- | 16/5/4 | 19/2/18 | 20/0/17 |
| | NIST | -- | -- | 15/5/2 | 18/2/13 | 19/0/10 |
| | NOAA | 1/0/0 | 1/0/0 | 1/0/1 | 1/0/2 | 1/0/4 |
| | ITS | 0/0/1 | 0/0/1 | 0/0/1 | 0/0/3 | 0/0/3 |
| ?**Other IP licenses**, income bearing | | 0 | 0 | 0 | 0 | 0 |

| | | FY 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|---|
| ? **All royalty bearing licenses**,[2] number | | 20 | 18 | 22 | 36 | 34 |
| ?**Invention licenses**, royalty bearing | | 20 | 18 | 22 | 36 | 34 |
| - Patent licenses [1] | Department | 20 | 18 | 22 | 36 | 34 |
| | NIST | 18 | 16 | 19 | 33 | 29 |
| | NOAA | 1 | 1 | 2 | 3 | 5 |
| | ITS | 1 | 1 | 1 | 0 | 0 |
| ?**Other IP licenses**, royalty bearing | | 0 | 0 | 0 | 0 | 0 |

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

(1) Patent license tally includes patent applications which are licensed.
(2) Note that royalties are one component of total license 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.

## Licensing Management

| | | FY 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|---|
| ? **Elapsed execution time**,[1] licenses granted in the FY | | | | | | |
| ?**Invention licenses**, average, months | | | | | | |
| | NIST | -- | -- | 4.8 | 5.4 | 3.4 |
| | NOAA | -- | -- | 8* | 8* | 5 |
| | ITS | -- | -- | ** | 5** | 1 |
| ? **Licenses terminated for cause**, number in the FY | | | | | | |
| ?**Invention licenses** | | | | | | |
| | NIST | -- | -- | 7 | 3 | 1 |
| | NOAA | -- | -- | 0 | 0 | 0 |
| | ITS | -- | -- | 0 | 0 | 0 |

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

For additional statistics on these metrics see the corresponding table in each of the later agency chapters of this report.

(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.)

* For NOAA, no new licenses were executed in FY 1999 and 2000. Also, in FY 2001 and 2002, only a single license was executed.
** For ITS, no new licenses were executed in FY 1999 and 2000. Also, in FY 2001 and 2002, only a single license was executed.

## Income from Licensing

| | | FY 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|---|
| ? **Total income**, all licenses active in FY [1] | | $405,469 | $186,368 | $268,568 | $164,622 | $127,566 |
| ? **Invention licenses** | | $405,469 | $186,368 | $268,568 | $164,622 | $127,566 |
| - Patent licenses [2] | Department | $405,469 | $186,368 | $268,568 | $164,622 | $127,566 |
| | NIST | $394,387 | $122,575 | $261,968 | $89,750 | $122,850 |
| | NOAA | $100 | $100 | $1,600 | $9,402 | $4,716 |
| | ITS | $10,982 | $63,693 | $5,000 | $65,470 | $0 |
| ? **Other IP licenses**, total active in the FY | | $0 | $0 | $0 | $0 | $0 |
| | | | | | | |
| ? **Total Earned Royalty Income** [3] | | $405,469 | $186,368 | $263,568 | $99,152 | $127,566 |
| ? **Invention licenses** | | $405,469 | $186,368 | $263,568 | $99,152 | $127,566 |
| - Patent licenses [2] | Department | $405,469 | $186,368 | $263,568 | $99,152 | $127,566 |
| | NIST | $394,387 | $122,575 | $261,968 | $89,750 | $122,850 |
| | NOAA | $100 | $100 | $1,600 | $9,402 | $4,716 |
| | ITS | $10,982 | $63,693 | $0 | $0 | $0 |
| ? **Other IP licenses**, total active in the FY | | $0 | $0 | $0 | $0 | $0 |

(1) Total income includes license issue fees, earned royalties, minimum annual royalties, paid-up license fees, and reimbursement for full-cost recovery of goods and services provided by the lab to the licensee including patent costs.
(2) Patent license tally includes patent applications which are licensed.
(3) "Earned royalty" = royalty based upon use of a licensed invention (usually, a percentage of sales or of units sold). Not a license issue fee or a minimum royalty.

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 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|---|
| ? **Income distributed** [1] | | | | | | |
| ? **Invention licenses** | Department | $405,469 | $186,368 | $268,568 | $164,622 | $127,566 |
| | NIST | $394,387 | $122,575 | $261,968 | $89,750 | $122,850 |
| | NOAA | $100 | $100 | $1,600 | $9,402 | $4,716 |
| | ITS | $10,982 | $63,693 | $5,000 | $65,470 | $0 |

| | | FY | FY | FY | FY | FY |
|---|---|---|---|---|---|---|
| - To inventor(s) | Department | $146,957 (36%) | $77,931 (43%) | $106,440 (39%) | $67,387 (41%) | $52,903 (41%) |
| | NIST | $142,262 (36%) | $57,423 (47%) | $102,040 (39%) | $45,650 (51%) | $51,773 (42%) |
| | NOAA | $0 (0%) | $0 (0%) | $1,500 (94%) | $696 (7%) | $1,130 (24%) |
| | ITS | $4,695 (43%) | $20,508 (32%) | $2,900 (58%) | $21,041 (32%) | $0 (0%) |
| - To other [2] | Department | $258,412 (64%) | $108,437 (58%) | $162,128 (60%) | $88,529 (59%) | $74,662 (59%) |
| | NIST | $252,125 (64%) | $65,152 (53%) | $159,928 (61%) | $44,100 (49%) | $71,076 (58%) |
| | NOAA | $100 (100%) | $100 (100%) | $100 (6%) | $8,706 (93%) | $3,586 (76%) |
| | ITS | $6,287 (57%) | $43,185 (68%) | $2,100 (42%) | $44,429 (68%) | $0 (0%) |

Invention licenses are the chief policy interest in regard to income disposition. This table reflects this focus.

(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 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|---|
| Standard Reference Materials (SRMs) available | NIST | 1,288 | 1,292 | 1,335 | 1,353 | 1,214 |
| Standard Reference Materials (SRMs) sold | NIST | 33,347 | 34,020 | 31,985 | 30,996 | 29,527 |
| Standard Reference Data (SRD) titles available | NIST | 60 | 63 | 65 | 90 | 106 |
| Number of items calibrated | NIST | 3,118 | 2,969 | 3,192 | 2,924 | 3,459 |
| Technical publications produced | NIST | 2,270 | 2,250 | 2,207 | 2,236 | 1,918 |
| | ITS | 32 | 20 | 17 | 17 | 20 |

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

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

## ? *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** | ? "Out of this world" atomic clock – NIST is working in conjunction with NASA to place an extremely accurate atomic clock aboard the International Space Station. This clock will provide new opportunities for fundamental research in physics, as well as a way to improve the accuracy of timekeeping on earth.<br><br>? Composition standard for peanut butter – NIST's recently released Standard Reference Material for peanut butter (SRM 2387), based on state-of-the-art measurement methods provides values for fat, protein, vitamins, minerals, and other substances present. This new standard will be used by food manufacturers to validate production and quality control procedures, as well as to ensure accurate labeling of product content.<br><br>? Better tools for measuring light reflectivity fromroadway signs – Road signs and markings are designed to be visible at night through "retroreflectivity," that is, by their ability to reflect some of the light emitted by oncoming vehicles back toward drivers' eyes. NIST has recently developed improved methods for measuring retroflectivity. These new measurement tools are expected to provide a basis for designing better and safer highway signs and markings.<br><br>? Improved lab analysis of male DNA – Genomics related research by NIST over the last several years has yielded an improved lab method and standard reference material for analyzing male DNA. This new standard is expected to be useful in forensic work, paternity analyses, and population studies of human evolution.<br><br>? Improved reliability in military communications technology – NIST researchers, in conjunction with a private company, have developed a significantly improved optical fiber power detector. This new system will provide a significant benefit to military calibration centers, which are responsible for the accuracy of optical fiber power systems used in the field.<br><br>? Standards for measuring micromachine properties – Microelectromechanical systems (MEMS), also known as "micromachines," are a new technology that uses existing microelectronics manufacturing methods to create complex machines with micrometer sized features. MEMS devices represent a rapidly growing sector of the semiconductor industry. NIST has recently helped develop 3 ASTM International Standard test methods for thin films used to make micromachines. This standard will help manufacturers ensure their micro devices are made to the exacting specifications on dimensions and materials needed for reliable operation. |

| Agency | Downstream Outcomes Listed |
|---|---|
| | ? Novel scanning-tunneling microscope system for nanometer measurements and etching – NIST R&D to date has yielded a novel device capable of resolving distances smaller than the radius of an atom and a reliable method for writing 10 nanometer sized features on silicon. Aiming ultimately for an accuracy of less than 1 nanometer, NIST is working toward supplying the semiconductor industry with benchmark references to calibrate measurement tools for both research and production.<br><br>? Smart materials to aid in reparing defective teeth – "Smart" materials invented at NIST may soon be available that stimulate repair of defective teeth. Lab studies show that these composites -- made of amorphous calcium phosphate embedded in polyers -- can efficiently promote regro wth of tooth structures. NIST is currently working with the National Institutes of Health (NIH) and the American Dental Association to promote the further development and commercialization of these materials.<br><br>? Improved methods of testing for use of illict drugs – NIST has recently developed two new Standard Reference Materials which aid the use of human hair samples in detecting the use of illicit drugs such as cocaine, PCP, codeine, and THC. Analysis of hair samples provide a means to both ease the collection of samples and substantially extend the period of time after use where positive identification can be made.<br><br>? Device to help blind/visually impaired people to feel images – A new technology developed by NIST researchers allows people who are blind or visually impaired to feel electronic images. The device -- termed a tactile graphic display -- uses an array of more than three thousand rounded pins that can be raised in any pattern and then locked into place. Unlike embossed images on paper, the tactile display can be used over and over again.<br><br>? Improved standards for radiation detectors and monitors – NIST researchers are working with the Institute of Electrical and Electronics Engineers (IEEE) and the American National Standards Institute (ANSI) to develop new standards for a variety of radiation detectors and monitors. These new standards are directed in part at Homeland Security related tasks -- such as helping to detect "dirty bombs" and related radiation hazards.<br><br>? Improved standards for civilian gas masks – NIST has teamed up with the National Institute for Occupational Health and Safety (NIOSH) and the Army's Soldier and Biological Chemical Command to develop a full suite of gas mask standards for civilian workers. These standards are particularly relevant for the conditions firefighters and other first responders may encounter in terrorist incidents or other emergency response circumstances.<br><br>? Online database to aid consumers in choosing among house repair options – NIST researchers have developed a free software program that helps homeowners select the most cost-effective replacement materials for roofing, siding, windows, and garage doors. The |

| Agency | Downstream Outcomes Listed |
|---|---|
| | software accounts for the owner's zip code and includes cost estimates for replacements, including cost of local labor and materials, and for ongoing maintenance.<br><br>? New software to aid engineerings in designing more efficient residential air conditioners – New simulation software developed by NIST will help cooling system manufacturers meet Department of Energy goals calling for a 20% increase by 2006 in the energy efficiency of residential air conditioners. |
| **National Oceanic and Atmospheric Administration** | ? Accurate warnings and track forecasts for Hurricane Isabel – NOAA's teamwork, warnings, and forecasts helped reduce the toll on lives of property of this severe September 2003 storm episode.<br><br>? Shift to five day advance forecasts for hurricanes – Improved forecasting methods and databases have allowed the usual three-day in advance forecasts to be enlarged to five-day in advance forecasts.<br><br>? Improved leadtime warnings for tornadoes – NOAA teamwork and improved methods enabled a significant improvement in warning leadtime during the particularly severe weather period of May 4-10, 2003.<br><br>? Print-on-demand nautical charts – A NOAA CRADA with a private sector partner has provided an electronic commerce, print-on-demand service for users to access NOAA's suite of more than a thousand nautical charts.<br><br>? Public access to atmosphere and ocean models – A NOAA lab has released several Earth System model components and model data to university collaborators and the public.<br><br>? Web-based access to earth science databases – A NOAA lab has transferred Live Access Server software for web-based visualization and downloading of earth science data sets to a broad scientific community.<br><br>? Scientific Graphics Toolkit and ncBrowse – A NOAA lab has developed Java-based tools to more easily visualize oceanographic (and other) data in both web and desktop computer applications. |
| **National Telecommunications and Information Administration -- Institute for Telecommunication Sciences** | ? Video quality metric – ITS has developed a superior method of measuring video quality objectively by machine, which closely predicts the quality that subjective human vision would perceive.<br><br>? Comarco Cellular test equipment – ITS-developed MNB speech quality estimation algorithm, licensed to a U.S. test equipment manufacturer, used by major cellphone service providers to test, diagnose, and maintain cellular radio systems.<br><br>? Personal communications services – Cooperative R&D with a major IT industry research laboratory on smart antenna performance. This |

| Agency | Downstream Outcomes Listed |
|---|---|
| | technology is targeted to dramatically increase the capacity of wireless systems and, thereby, reduce the problem of spectrum crowding.<br><br>? Local multipoint distribution services – Continuing cooperative R&D with industry partners on radio propagation for LMDS, which (among other results) provides broadband wireless communications for business and residential applications. |

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

## ¦ Progress in Improving the Department's Performance Metrics for Technology Transfer

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

The content and format of this year's performance report is consistent with guidelines issued for the annual performance reporting by the Office of Management and Budget in its July 2003 edition of Circular A-11. (OMB's guidelines draw closely from the performance reporting approach organized by the Interagency Working Group on Technology Transfer/Department of Commerce, in December 2001 and revised in December 2002. This approach has been the basis for the Department of Commerce's and other agencies' reporting over the last several years.)

Further developed again this year are the agencies' discussions of technology transfer efforts through mechanisms beyond the cooperative R&D, patenting, and licensing that comprises the mainstream currently of technology transfer for most agencies. Included here are 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.

Plans for technology transfer activities by the Department of Commerce's federal labs generally continue to emphasize the development of better metrics for program performance. Ongoing initiatives include the following:

? NIST:
?NIST continues to evaluate the effectiveness of the wide variety of mechanisms employed for technology transfer.

? In the FY 2002 and 2003 annual reports, NIST added new categories for non-traditional CRADA's to cover NIST calibration services, provide greater detail on licenses and license income, address workshops, conferences, and publications, and include participation by NIST staff in documentary standards committees.

? The NIST Director has asked the National Research Council's Board on Assessment, as part of its annual assessment of the NIST laboratories, to examine the effectiveness of the 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.

**?** NOAA

NOAA has found the conventional technology transfer mechanisms of patenting and licensing of research products and participating in CRADA's to be far less effective in achieving NOAA's mission than the open dissemination of NOAA's scientific products and services. Accordingly, the vast majority of the agency's technology transfer is accomplished through the open dissemination methods more traditional for scientific organizations.

? Nonetheless, the recent emphasis on performance measurements for agency technology transfer activities have resulted in an enhanced NOAA effort to monitor and update agency management information about these activities.

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

**?** ITS

? ITS' annual performance reporting has been revised to conform to the Department of Commerce guidelines. Starting in 2002, ITS added a new metric under the "Other Performance Measures" category: "number of publications approved through the Editorial Review Board (ERB) process." While not perfect, this metric provides a useful, working indicator of the number of quality publications released to the public.

? In addition, ITS continues to explore other 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. TECHNOLOGY ADMINISTRATION -- NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY*

## *Technology Transfer at the Agency's Federal Laboratories – Approach and Plans, FY 2003 Activities/Achievements*

## 1. Agency Approach and Plans for Technology Transfer

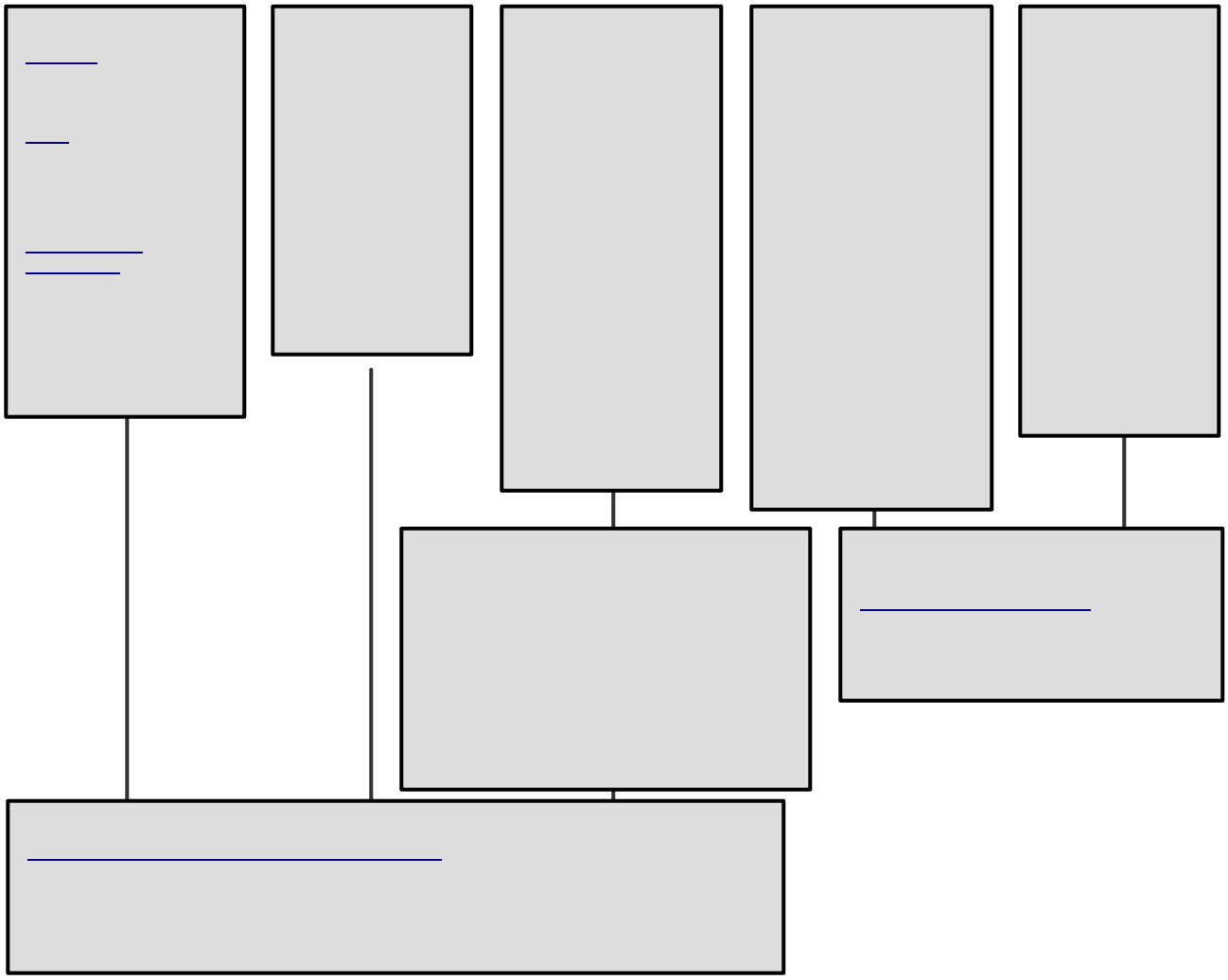
The mission of the National Institute of Standards and Technology (NIST) is to develop and promote measurements, standards, and technology to enhance productivity, facilitate trade, and improve the quality of life. NIST's laboratories develop and disseminate measurement techniques, reference data, test 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, publications, 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.[2]

- **Standard Reference Materials**

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

[2] 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).

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.

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. In FY 2003, NIST accredited 72 calibration laboratories in fields ranging from dimensional metrology to optical and chemical. Through this overall approach, NIST efficiently leverages 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 2003, NIST Public and Business Affairs handled about 9600 inquiries. In addition, during FY 2003, this office managed 130 conferences with about 11,000 attendees 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.[3] 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.

[3] Statistics on NIST's participation in these standards committees are collected on a calendar year (CY) rather than fiscal year (FY) basis. At time of this report, the CY 2002 figures cited are the most recent available. However, the CY 2003 figures are not expected differ significantly.

## 2. Performance in FY 2003: 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 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|
| ? **CRADAs**, total active in the FY [1] | 261 | 208 | 174 | 1,812 | 1,653 |
| - New, executed in the FY | 62 | 40 | 22 | 1,712 | 1,589 |
| ? Traditional CRADAs,[2] total active in the FY | 261 | 208 | 174 | 125* | 76* |
| - New, executed in the FY | 62 | 40 | 22 | 25 | 12 |
| ? Non-traditional CRADAs,[3] total active in the FY | -- | -- | 0 | 1,687 | 1,577 |
| - New, executed in the FY | -- | -- | 0 | 1,687** | 1,577** |
| ? **Other types of collaborative R&D relationships** | | | | | |
| ? Facility use agreements, total in effect a end of FY [4] | -- | -- | 372 | 391 | 512 |
| -New, executed in the FY | -- | -- | 172 | 62 | n/a |
| ? Guest scientists and engineers during the FY [5] | -- | -- | 1,200a | 1,300a | 1,300a |

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

(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. (DA/CFO).
(3) CRADAs used for special purposes -- such as, material transfer or technical assistance that may result in protected information.
(4) NIST authorizes individuals to use designated facilities. The numbers reported here represent the Facility Use Agreements in effect for the NIST Center for Neutron Research.
(5) "Guest scientists and engineers" includes foreign and domestic guest researchers, and researchers working at NIST under Intergovernmental Personnel Act (IPA) Agreements 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.

**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. Such "non-traditional" CRADA's are issued (and terminate) on an annual basis. Similarly, 1,577 "non-traditional" CRADA's were issued in FY 2003.

## Invention Disclosure and Patenting

| | FY 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|
| ? New inventions disclosed in the FY [1] | 35 | 32 | 24 | 16 | 16 |
| ? Patent applications filed in the FY [2] | 27 | 18 | 9 | 11 | 5 |
| ? Patents issued in the FY | 26 | 14 | 20 | 15 | 7 |
| ? Active patents, end of the FY | -- | -- | -- | 199 | 198 |
| ? Patents purposely dropped (triaged) during the FY | -- | -- | -- | 34 | 17 |

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

(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 | FY 2003 |
|---|---|---|---|---|---|
| ? **All licenses**, number total active in the FY [1] | 40 | 39 | 36 | 35 | 39 |
| ? New, executed in the FY | 7 | 3 | 4 | 2 | 3 |
| ? **Invention licenses**, total active in the FY | 40 | 39 | 36 | 35 | 39 |
| ? New, executed in the FY | 7 | 3 | 4 | 2 | 3 |
| - Patent licenses,[2] total active in FY | 40 | 39 | 36 | 35 | 39 |
| ? New, executed in the FY | 7 | 3 | 4 | 2 | 3 |
| - Material transfer licenses (inventions), total active | 0 | 0 | 0 | 0 | 0 |
| ? New, executed in the FY | 0 | 0 | 0 | 0 | 0 |
| - Other invention licenses, total active in the FY | 0 | 0 | 0 | 0 | 0 |
| ? New, executed in the FY | 0 | 0 | 0 | 0 | 0 |
| ? **Other IP licenses**, total active in the FY | 0 | 0 | 0 | 0 | 0 |
| ? New, executed in the FY | 0 | 0 | 0 | 0 | 0 |
| - Copyright licenses (fee bearing) | | | | | |

| | FY 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|
| ? New, executed in the FY | | | | | |
| - Material transfer licenses (non-inventions), total active | | | | | |
| ? New, executed in the FY | | | | | |
| - Other, total active in the FY | | | | | |
| ? New, executed in the FY | | | | | |

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

(1) "Active" = legally in force at any time during the FY.
(2) Patent license tally includes patent applications which are licensed.

**Profile of Active Licenses (cont.)**

| | FY 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|
| ? **All income bearing licenses**, total number | 18 | 16 | 19 | 33 | 29 |
| ? Exclusive | -- | -- | 12 | 18 | 19 |
| ? Partially exclusive | -- | -- | 5 | 2 | 0 |
| ? Non-exclusive | -- | -- | 2 | 13 | 10 |
| ? **Invention licenses**, income bearing | 18 | 16 | 19 | 33 | 29 |
| ? Exclusive | -- | -- | 12 | 18 | 19 |
| ? Partially exclusive | -- | -- | 5 | 2 | 0 |
| ? Non-exclusive | -- | -- | 2 | 13 | 10 |
| - Patent licenses,(1) income bearing | 18 | 16 | 19 | 33 | 29 |
| ? Exclusive | -- | -- | 12 | 18 | 19 |
| ? Partially exclusive | -- | -- | 5 | 2 | 0 |
| ? Non-exclusive | -- | -- | 2 | 13 | 10 |
| ? **Other IP licenses**, income bearing | 0 | 0 | 0 | 0 | 0 |
| ? Exclusive | | | | | |
| ? Partially exclusive | | | | | |
| ? Non-exclusive | | | | | |
| - Copyright licenses (fee bearing) | | | | | |
| ? Exclusive | | | | | |
| ? Partially exclusive | | | | | |
| ? Non-exclusive | | | | | |
| ? **All royalty bearing licenses**,(2) total number | 18 | 16 | 19 | 33 | 29 |
| ? **Invention licenses**, royalty bearing | 18 | 16 | 19 | 33 | 29 |
| - Patent licenses,(1) royalty bearing | 18 | 16 | 19 | 33* | 29 |
| ? **Other IP licenses**, royalty bearing | 0 | 0 | 0 | 0 | 0 |

| | FY 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|
| - Copyright licenses (fee bearing) | | | | | |

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

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

(1) Patent license tally includes patent applications which are licensed.
(2) Note that royalties are one component of total license income.

* Of the 35 licenses active in FY 2002 (see the previous table), 2 were royalty-free research licenses.

## Licensing Management

| | FY 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|
| ? **Elapsed execution time**,[1] licenses granted in the FY | | | | | |
| ? **Invention licenses** | | | | | |
| ? Average, months | -- | -- | 4.75 | 5.4 | 3.4 |
| ? Minimum | -- | -- | 2 | 2.5 | 1 |
| ? Maximum | -- | -- | 5 | 5 | 10 |
| - Patent licenses [2] | | | | | |
| ? Average, months | -- | -- | 4.75 | 5.4 | 3.4 |
| ? Minimum | -- | -- | 2 | 2.5 | 1 |
| ? Maximum | -- | -- | 5 | 5 | 10 |
| ? **Licenses terminated for cause**, number in the FY | | | | | |
| ? **Invention licenses** | -- | -- | 7 | 3 | 1 |
| - Patent licenses [2] | -- | -- | 7 | 3* | 1 |

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

(1) Date of license application to the date of license execution. (Date of license application is the date the lab formally acknowledges the written request for a license from a prospective licensee and agrees to enter into negotiations.)
(2) Patent license tally includes patent applications which are licensed.

* 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 | FY 2003 |
|---|---|---|---|---|---|
| ? **Total income**, all licenses active in the FY [1] | $394,387 | $122,575 | $261,968 | $89,750 | $122,850 |
| ?**Invention licenses** | $394,387 | $122,575 | $261,968 | $89,750 | $122,850 |
| - Patent licenses [2] | $394,387 | $122,575 | $261,968 | $89,750 | $122,850 |
| ?**Other IP licenses**, total active in the FY | 0 | 0 | 0 | 0 | 0 |
| - Copyright licenses | | | | | |
| | | | | | |
| ? **Total Earned Royalty Income** (ERI) [3] | $394,387 | $122,575 | $261,968 | $89,750 | $122,850 |
| ? Median ERI | -- | -- | n/a | $2,300 | n/a |
| ? Minimum ERI | -- | -- | $1,000 | $700 | $960 |
| ? Maximum ERI | | | $135,927 | $20,000 | $35,000 |
| ? ERI from top 1% of licenses | -- | -- | n/a | $20,000 | $35,000 |
| ? ERI from top 5% of licenses | -- | -- | n/a | $20,000 | $35,000 |
| ? ERI from top 20% of licenses | -- | -- | n/a | $50,000 | $45,000 |
| ?**Invention licenses** | $394,387 | $122,575 | $261,968 | $89,750 | $122,850 |
| ? Median ERI | -- | -- | n/a | $2,300 | n/a |
| ? Minimum ERI | -- | -- | $1,000 | $700 | $960 |
| ? Maximum ERI | | | $135,927 | $20,000 | $35,000 |
| ? ERI from top 1% of licenses | -- | -- | n/a | $20,000 | $35,000 |
| ? ERI from top 5% of licenses | -- | -- | n/a | $20,000 | $35,000 |
| ? ERI from top 20% of licenses | -- | -- | n/a | $50,000 | $45,000 |
| - Patent licenses [2] | $394,387 | $122,575 | $261,968 | $89,750 | $122,850 |
| ? Median ERI | -- | -- | n/a | $2,300 | n/a |
| ? Minimum ERI | -- | -- | $1,000 | $700 | $960 |
| ? Maximum ERI | | | $135,927 | $20,000 | $35,000 |
| ? ERI from top 1% of licenses | -- | -- | n/a | $20,000 | $35,000 |
| ? ERI from top 5% of licenses | -- | -- | n/a | $20,000 | $35,000 |
| ? ERI from top 20% of licenses | -- | -- | n/a | $50,000 | $45,000 |
| ?**Other IP licenses**, total active in the FY | 0 | 0 | 0 | 0 | 0 |
| ? Median ERI | | | | | |
| ? Minimum ERI | | | | | |
| ? Maximum ERI | | | | | |
| ? ERI from top 1% of licenses | | | | | |
| ? ERI from top 5% of licenses | | | | | |
| ? ERI from top 20% of licenses | | | | | |
| - Copyright licenses | | | | | |
| ? Median ERI | | | | | |
| ? Minimum ERI | | | | | |
| ? Maximum ERI | | | | | |
| ? ERI from top 1% of licenses | | | | | |
| ? ERI from top 5% of licenses | | | | | |
| ? ERI from top 20% of licenses | | | | | |

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

(1) Total income includes license issue fees, earned royalties, minimum annual royalties, paid-up license fees, and reimbursement for full-cost recovery of goods and services provided by the lab to the licensee including patent costs.
(2) Patent license tally includes patent applications which are licensed.
(3) "Earned royalty" = royalty based upon use of a licensed invention (usually, a percentage of sales or of units sold). Not a license issue fee or a minimum royalty.

### Disposition of License Income

| | FY 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|
| ? **Income distributed** [1] | | | | | |
| ? **Invention licenses**, total distributed | $394,387 | $122,575 | $261,968 | $89,750 | $122,850 |
| - To inventor(s) | $142,262 (36%) | $57,423 (47%) | $102,040 (39%) | $45,650 (51%) | $51,773 (42%) |
| - To other [3] | $252,125 (64%) | $65,152 (53%) | $159,928 (61%) | $44,100 (49%) | $71,076 (58%) |
| - Patent licenses,[2] total distributed | $394,387 | $122,575 | $261,968 | $89,750 | $122,850 |
| - To inventor(s) | $142,262 (36%) | $57,423 (47%) | $102,040 (39%) | $45,650 (51%) | $51,773 (42%) |
| -To other [3] | $252,125 (64%) | $65,152 (53%) | $159,928 (61%) | $44,100 (49%) | $71,076 (58%) |

Invention licenses are the chief policy interest in regard to income disposition. This table reflects this focus.

(1) Income includes royalties and other payments received during the FY.
(2) Patent license tally includes patent applications which are licensed.
(3) 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 | FY 2003 |
|---|---|---|---|---|---|
| Standard Reference Materials (SRMs) available [2] | 1,288 | 1,292 | 1,335 | 1,353 | 1,214 |
| Standard Reference Materials (SRMs) sold [3] | 33,347 | 34,020 | 31,985 | 30,996 | 29,527 |
| Standard Reference Data (SRD) titles available [4] | 60 | 63 | 65 | 90 | 106 |
| Number of items calibrated [5] | 3,118 | 2,969 | 3,192 | 2,924[7] | 3,459 |

| | FY 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|
| Technical publications produced [6] | 2,270 | 2,250 | 2,207 | 2,236 | 1,918 |

(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. NIST expects a continued slight decline in the number of SRM units sold, as NIST makes greater use of highly leveraged SRM services over time, including accreditation of Nationally Traceable Reference Material producers.
(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.
(7) 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 socioeconomic 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 – 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; nanoscale measurements and data; health care quality assurance; measurements and standards for Homeland Security and information and knowledge management;

***Measurements and Standards***

- **NIST helping prepare an 'out of this world' atomic clock.** Setting the world's clocks from a timepiece far above the Earth someday may be the norm if the National Institute of Standards and Technology (NIST)-led program to put an atomic clock aboard the International Space Station (ISS) proves successful. This effort is part of the NASA-funded Primary Atomic Reference Clock in Space (PARCS) mission, scheduled to fly on the ISS in early 2006. PARCS will be used to test gravitational theory, study laser-cooled atoms in microgravity and explore ways to improve the accuracy of timekeeping on Earth. Atoms in microgravity can be slowed to speeds significantly below those used in atomic clocks on Earth, providing a predicted 10-fold improvement in clock accuracy. (The current U.S. standard, the NIST-F1 clock, is accurate to within one second in 30 million years.) The PARCS space clock will be compared continuously to the hydrogen maser, a fundamentally different clock, to provide a test of an Einstein theory that predicts that two different kinds of clocks in the same environment will keep the same time. To measure gravitational frequency shift, comparisons will be made between the space clock and a clock on Earth. Signals conveyed to the ground from such space clocks someday might serve as an international time standard available to anyone around the world. PARCS is a cooperative effort involving NASA's Jet Propulsion Laboratory (JPL), NIST, Harvard-Smithsonian Center for Astrophysics, the University of Colorado at Boulder, and the University of Torino in Italy. JPL is leading the actual development of the space package.

- **Peanut butter standard spreads quality.** The National Institute of Standards and Technology (NIST) recently issued Standard Reference Material (SRM) 2387, a peanut butter sample characterized with state-of-the-art measurement methods to provide values for fat, protein, vitamins, minerals, and other substances it contains. It can be used by food manufacturers to validate production and quality control procedures, as well as to ensure accurate labeling of product content. The new SRM is the first NIST food-matrix reference material with values assigned for 18 individual amino acids -- the building blocks of proteins -- and for aflatoxins, carcinogenic substances produced by mold in crops. It also is the only SRM that is high in both fat content and protein, making it useful in evaluating the fat and protein content of other food products. SRM 2387 already has found a scientific use in evaluating allergen test kits. Even a trace of peanut protein can cause serious reactions, including death, if someone is highly allergic.

- **New NIST facility soon will be 'reflecting' on safer signs.** Roadways should get safer in the future, now that the National Institute of Standards and Technology (NIST) has developed a way to accurately and reliably measure how light reflects off stop signs and other road markings. Road signs and markings are designed to be visible at night by retroreflectivity -- that is, they reflect some of the light emitted by a vehicle's headlights back toward the driver's eyes. However, measurements of retroreflectivity have varied so much among different devices and laboratories that federal transportation officials have been unable to define minimum standards for this congressionally mandated characteristic. Recently, NIST established a facility, funded by the Transportation Research Board of the National Cooperative Research Program, that resolves numerous measurement problems and improves accuracy. Inside the facility, one finds a long black tunnel with a set of tracks on which sits an instrumented platform. Signs or

materials are mounted on the platform, which can be moved 3 to 30 meters (10 to 100 feet) from a light source at one end of the tunnel. Using custom software, scientists precisely control all of the components and measure the characteristics of light reflected from the sign to a detector located close to the source. NIST expects that the facility will begin providing calibration services early in 2004.

- **Standard improves tests of male DNA.** Mother Goose tells us that boys are made of "snips and snails and puppy dog tails." She was clearly misinformed about the snails and tails, but she was on to something with the snips. What you really need to build a boy is a "Y" chromosome, and it turns out that SNPs (single nucleotide polymorphisms), known by the biotech cognoscenti as simply "snips," can be helpful in sorting out who fathered the boy. If DNA can be thought of as an instruction book for building a specific person, then SNPs are single letters at an exact location in that book that tend to vary among individuals. A new Standard Reference Material (SRM) issued by the National Institute of Standards and Technology (NIST) uses both SNPs and STRs (sections where three to five DNA "letters" form repeating patterns) to help improve the reliability of laboratory analyses of male DNA. The result of several years of research, the standard consists of six vials of very carefully analyzed DNA. Five are male samples, and one is female. Laboratories that perform forensics or paternity DNA analyses can use the SRM to double check the accuracy of their equipment and test procedures for analyzing the Y chromosome. It also may be helpful for population studies that study whether the human race evolved from one or many "Adams." Each vial comes with certified DNA sequences for 22 different STR locations and 42 different SNPs.

- **System helps ensure reliability of military communications.** The Army, Navy and Air Force use thousands of miles of optical fibers on ships, planes and land-based installations to transmit voice and data. They needed a simple, effective, and highly accurate way to measure the amount of light delivered by these glass "wires" at key points in the transmission system. Power degradation along the network can cause communication failure. Working with ILX Lightwave Corp. of Bozeman, Mont., the National Institute of Standards and Technology (NIST) came up with a system capable of world-class optical measurements with push-button convenience. The system consists of a NIST-designed optical detector and an optical multimeter -- designed by ILX Lightwave -- that measures light emitted from a fiber over a wide range of wavelengths. There are two versions of the novel detector: one using silicon-based sensors and the other using germanium-based sensors. The sensors connect directly to an optical fiber without any additional optics and with barely measurable light loss. Measurement uncertainty is half that of previous optical fiber power detectors. The new systems are now being shipped to military calibration centers where they will be used to annually check the accuracy of optical fiber power systems utilized in the field.

### *Nanotechnology*

- **Standards to help manufacturers measure micromachine properties.** When a car collides with another car, a tiny device called an accelerometer detects the change in motion and sets off an air bag, an innovation that has saved many lives. The accelerometer is one of the most common uses of microelectromechanical systems (MEMS), but scientists and engineers also are

starting to use them in devices ranging from angioplasty pressure sensors and pacemakers to optical disk drives. MEMS, also known as micromachines, are a relatively new technology that uses existing microelectronics manufacturing methods to create complex machines with micrometer feature sizes. MEMS devices represent a rapidly growing component of the semiconductor industry. Many micromachines contain moving parts that are combined with integrated circuits. Like most high-tech devices, they must be made with precise dimensions and materials properties to operate properly. To help manufacturers ensure that their devices meet these exacting specifications, National Institute of Standards and Technology (NIST) scientists and engineers helped develop three ASTM International standard test methods for the thin films used to make micromachines. The test procedures, which are the first such standards in the world, will be published in The Annual Book of ASTM International Standards this month. The standards are expected to facilitate global commerce in MEMS technologies by enabling measurements that will lead to the development of more reliable and reproducible MEMS devices. The three standards provide detailed instructions for measuring thin-film dimensions and "strain," a property related to the stress in the thin film. NIST researchers have created a Web site to help semiconductor manufacturers perform the complex mathematical calculations required by the new standard test methods. For further information, see www.eeel.nist.gov/812/test-structures.

- **NIST helps chip industry measure features by counting atoms.** The quest to develop the nanotechnology equivalent of ruler length measurement references based on the spacing of atoms in a perfectly ordered crystal has inspired a burst of innovation at the National Institute of Standards and Technology (NIST). Progress to date has yielded a novel device that can resolve distances smaller than the radius of an atom and a reliable method for writing 10 nanometer sized features on silicon. NIST researchers are packaging the new technology and know-how into a scanning tunneling microscope (STM) system designed to write patterns with dimensions determined by counting the atoms that make up the patterns' structural features. Ultimately aiming for an accuracy of better than 1 nanometer, the team intends to supply the semiconductor industry with benchmark references to calibrate measurement tools used in research and production. To measure exceedingly small distances, members of the "atom-based artifacts project" developed a novel diode laser-based interferometer. The new, compact instrument incorporates elements of two types of existing interferometers -- devices that determine the distance between two objects on the basis of light interference patterns -- but achieves much higher levels of resolution. To date, the team has measured distances in increments smaller than 10 picometers, or less than one hundredth of a nanometer. Efforts to produce durable, silicon-based measurement references have paid off with a method for reliably writing patterns with 10 nanometer line widths -- equivalent to about 30 silicon atoms across. These STM-written patterns are long-lived, even outside of a vacuum, and recent work suggests that reactive ion etching can increase their three dimensional relief.

### *Healthcare*

- **Tooth, heal thyself**. "Smart materials" invented at the National Institute of Standards and Technology (NIST) soon may be available that stimulate repair of defective teeth. Laboratory studies show that these composites, made of amorphous calcium phosphate embedded in

polymers, can efficiently promote re-growth of tooth structures. In the presence of saliva-like solutions the material releases calcium and phosphate ions, forming a crystalline calcium phosphate similar to the mineral found naturally in teeth and bone. Developed through a long-standing partnership between NIST and the American Dental Association (ADA), initial applications for these bioactive, biocompatible materials include adhesive cements for orthodontic braces and anti-cavity liners underneath conventional fillings. NIH and NIST entered into an interagency agreement whereby NIST took the lead on prosecuting and licensing the smart dental material. After further development, NIST exclusively licensed the invention to the ADA, which has signed one commercialization license to date. This activity is an example of increasingly close ties between federal agencies, non-profit organizations and the private sector.

- **Hairs' to better drug testing.** There's a relatively new weapon in the battle against illicit drug use -- hair. Unlike urine or other body fluids, hair tissue retains traces of cocaine and other drugs for at least 90 days (not just two or three). Hair also is easier to collect and harder to switch or contaminate. As a result, hair analysis increasingly is used to screen job applicants, athletes, and others for illicit drug use. The accuracy of such tests now can be checked through the use of two new National Institute of Standards and Technology (NIST) Standard Reference Materials (SRM's). The standards consist of human hair segments that have been soaked in solutions containing target drugs and then carefully measured for drug concentrations. SRM 2379 is designed for calibrating tests of stimulants ("uppers") such as cocaine and PCP, while SRM 2380 helps check tests for depressants ("downers"), such as codeine and THC (the active ingredient in marijuana). Drugs usually are not detectable in hair samples until 10 days after use, so hair analysis is likely to complement rather than completely replace traditional screening methods.

- **Device lets blind feel images.** A new technology developed by National Institute of Standards and Technology (NIST) researchers allows people who are blind or visually impaired to feel electronic images. Called a tactile graphic display, the device uses an array of more than 3,000 rounded pins that can be raised in any pattern and then locked into place. The inspiration for the tactile graphic display came from a "bed of nails" toy found in a novelty store. The NIST researchers just needed a way to connect an array of moveable pins with electric signals. The answer came in the form of outdated technology. The researchers took a 20-year-old scientific pen plotter and made it work upside down. Instead of pushing a pen down to draw images on paper, the device now pushes pins up to form an image. Unlike embossed images on paper, the tactile display can be used over and over again. Each image is sent electronically to the device, which uses software to determine how to create a tactile display that matches the image. The display converts scanned illustrations, photographs, map outlines, or other graphical images into raised patterns and can translate images displayed on Internet Web pages or in electronic books. After the pins are "viewed" with the fingertips, they can be withdrawn to form a flat surface ready to be reset into a new image. NIST is working with the private sector to apply the technology under a non-exclusive research license. In addition, several patents are pending on the technology and commercialization licenses are available.

***Homeland Security***

- **Finding dirty bombs and other radiation threats.** In an age of terrorism, law enforcement agents and other first responders need to be prepared for a wide range of threats, including so-called "dirty bombs" and other radiation hazards. To help ensure the performance of devices used to detect such threats, National Institute of Standards and Technology (NIST) researchers are working with the Institute of Electrical and Electronics Engineers (IEEE) and the American National Standards Institute (ANSI) to develop new standards for a variety of radiation detectors and monitors. With partial funding from the Department of Homeland Security (DHS) and NIST's Office of Law Enforcement Standards, NIST researchers are investigating a wide variety of detection devices, ranging from 3-meter-high portal towers that scan truck trailers while they move through checkpoints to small, pager-size monitors that serve as personal dosimeters. Many of these devices originally were designed for monitoring workers in factories and laboratories. The new standards under development will ensure that the devices work as intended under the new conditions now encountered in homeland security related tasks. For example, some devices work differently in the rain or high humidity conditions, as well as in wide temperature ranges. So far, the NIST researchers also have found that the calibration of some detectors depends a lot on the exposure rate and energy of the radiation detected. The accuracy of 19 different hand-held detectors ranged within plus or minus 5 percent of the actual radiation value to plus or minus 40 percent depending on whether they were measuring high, medium or low energy radiation sources.

- **Ensuring the safety of first responder gas masks.** Firefighters and other first responders faced with a terrorist attack soon will breathe a little easier knowing that their gas masks have been tested to ensure they work properly under emergency response conditions. Air purifying respirators, commonly known as gas masks, protect workers from hazards associated with chemical, biological, radiological and nuclear (CBRN) agents. The National Institute of Standards and Technology (NIST) has teamed up with the National Institute for Occupational Safety and Health (NIOSH) and the U.S. Army Soldier and Biological Chemical Command to develop a full suite of gas mask standards for civilian workers. Scientists will begin live agent testing of masks this spring at the Army's Aberdeen Proving Grounds in Maryland, one of only a few nationwide laboratories that can do such tests safely. The tests will ensure that the masks protect workers from a mustard blistering agent and from the nerve gas sarin. The tests are done on specially designed mannequins that can precisely measure minute amounts of vapor that may penetrate through the masks. Masks worn by first responders must meet different standards from those designed for troops. Most military uses involve outdoor attacks where air currents would naturally disperse chemicals or other hazardous agents. The civilian testing procedures address release of a hazardous agent inside buildings or other closed environments. The standard will include a maximum penetration rate for hazardous substances and methods for testing the fit of gas masks for individuals.

***Information and Knowledge Management***

- **Helping consumers choose among house repair options.** House maintenance is a never-ending and costly task. Roofing, siding, windows and even garage doors wear out. Now

researchers at the National Institute of Standards and Technology (NIST) have developed a software program that takes the guesswork out of replacement decisions. The free program, called NEST (for National Economic Service-life Tools), allows homeowners to select the most cost-effective replacement material for roofing, siding, windows and garage doors. It also provides, for the user's own zip code, cost estimates for replacements, including the cost of local labor and local materials, as well as the cost of maintenance. NEST currently consists of two software tools. "NEST Builder" and "Durability Doctor." NEST Builder asks homeowners to specify the house layout and size, as well as various kinds of materials used for roofing, siding, windows and garage doors. The software program uses the information to build a virtual or graphic model of a user's home. "Durability Doctor" then combines the house model data with information on material cost and service life of the selected housing component. It estimates the installation and maintenance cost as well as the monthly financing cost of each alternative over the product's lifetime. Consumers then can compare costs for nine different types of roofing, four garage door materials, six types of windows and eight varieties of siding. "Durability Doctor" also reports which replacements are the most durable, have the lowest installation cost and lowest life-cycle cost for each housing component. NIST developed NEST with funds from the Partnership for Advancing Technology in Housing, a government-industry initiative led by the Department of Housing and Urban Development to modernize the homebuilding industry. NEST is available at www.pathnet.org/sp.asp?

- **Designing efficient cooling systems for the dog days of summer.** New software developed by National Institute of Standards and Technology (NIST) can help cooling system manufacturers meet Department of Energy goals calling for a 20 percent increase in energy efficiency of residential air conditioners by 2006. Manufacturing engineers can use the software, called EVAP-COND, to improve evaporators and condensers, two types of heat exchangers that are essential components of every air conditioner. Improved heat exchangers mean increased energy efficiency. The software simulations depict the performance of evaporators and condensers working with any one of 10 cooling agents, including new generation atmospheric ozone-safe hydrofluorocarbon fluids and "natural refrigerants," such as carbon dioxide or propane. The software's computer graphics package enables engineers to observe and to understand refrigerant behavior throughout the simulated heat exchanger. Different designs can be tested to achieve desired environmental results. According to the software developer, "EVAP-COND can increase design engineer productivity and can reduce laboratory testing, thus shortening design-to-production time. This software can save manufacturers time and money, while it is helping to conserve energy." NIST developed the software with funds from the 21st Century Research Program of the Air-conditioning and Refrigeration Technology Institute and the U.S. Department of Energy. The Windows-based program can be downloaded from www2.bfrl.nist.gov/software/evap-cond/.

# *III. NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION*

## *Technology Transfer at the Agency's Federal Laboratories – Approach and Plans, FY 2003 Activities/Achievements*

### 1. Agency Approach and Plans for Technology Transfer

The National Oceanic and Atmospheric Administration (NOAA) is one of the world's foremost scientific and environmental agencies. It is a critical part of our Nation's economic structure. NOAA science and technology products impact the daily lives of every one of our citizens, and have economic consequences which significantly affect our Nation's Gross Domestic Product. For example, about one-third of the U.S. economy (approximately $3 trillion) is weather sensitive.

NOAA's mission is to understand and predict changes in the Earth's environment and conserve and manage coastal and marine resources to meet the Nation's economic, social, and environmental needs. NOAA's primary technology transfer mechanism has historically been the open dissemination of scientific and technical information to individuals, industry, government, and universities. This means of technology transfer is consistent with the agency's mission and *scientific tradition* and has been found to be more efficient and economical than transfer through patenting and licensing. 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 and warnings of severe weather events.

For FY 2003, NOAA carried out an extensive technology transfer program by not only providing the daily weather forecasts and warnings through the media and through NOAA Weather Radio, but also by applying meteorological and oceanographic technologies and information through open dissemination to individuals, industry, government, and universities. NOAA technology is also transferred through presentations at scientific meetings, publication of meeting papers, publication in peer reviewed scientific journals, and through NOAA scientific and technical publications. NOAA Weather Radio has been integrated into the Nation's homeland security efforts and will be used to alert citizens to chemical or nuclear spills and terrorist attacks.

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, El Nino, tides and currents, satellite imagery and direct readout, fishery statistics and information on protected species, air quality, state of the coasts, beach temperatures, and nautical charts, as well as extensive data bases on climate, oceans, geophysics, and the sun.

The understanding and forecasting of global phenomena that occur in the atmosphere, oceans, and on the sun require collaboration and information sharing with organizations in countries

throughout the world. This is accomplished through formal agreements with individual countries and participation in international organizations, such as the World Meteorological Organization(WMO), Intergovernmental Oceanographic Commission(IOC), and International Astronomical Union (IAU). NOAA also participates in international scientific expeditions with other nations to share technology and scientific data. In addition, NOAA provides technical assistance and training to individuals from other countries, and participates in a visiting scientist program. Much environmental data is also shared through NOAA's participation in the World Data Center program.

In future years, NOAA will continue to carry out these considerable technology transfer activities and international collaboration, 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 benefit the competitiveness of U.S. industry, NOAA will also continue to provide intellectual property to industry through licenses, CRADAs, or by open dissemination.

# 2. Performance in FY 2003: Activities and Achievements

## ¦ Collaborative Relationships for Research & Development

| | FY 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|
| ? **CRADAs**, total active in the FY [1] | 8 | 10 | 8 | 8 | 11 |
| - New, executed in the FY | 1 | 3 | 3 | 1 | 0 |
| ? Traditional CRADAs,[2] total active in the FY | 8 | 10 | 8 | 8 | 11 |
| - New, executed in the FY | 1 | 3 | 3 | 1 | 0 |
| ? Non-traditional CRADAs,[3] total active in the FY | 0 | 0 | 0 | 0 | 0 |
| - New, executed in the FY | 0 | 0 | 0 | 0 | 0 |
| ? **Other types of collaborative R&D relationships** | 0 | 0 | 0 | 0 | 0 |

Figures for FY 2003 are estimates at time of this report.

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 | FY 2003 |
|---|---|---|---|---|---|
| ? New inventions disclosed in the FY [1] | 3 | 2 | 1 | 1 | 5 |
| ? Patent applications filed in the FY [2] | 2 | 2 | 3 | 0 | 0 |
| ? Patents issued in the FY | 2 | 2 | 1 | 5 | 1 |

Figures for FY 2003 are estimates at time of this report.

(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 | FY 2003 |
|---|---|---|---|---|---|
| ? **All licenses**, number total active in the FY [1] | 2 | 2 | 2 | 3 | 5 |
| ? New, executed in the FY | 1 | 0 | 1 | 1 | 2 |
| ? **Invention licenses**, total active in the FY | 2 | 2 | 2 | 3 | 5 |
| ? New, executed in the FY | 1 | 0 | 1 | 1 | 2 |
| - Patent licenses,[2] total active in FY | 2 | 2 | 2 | 3 | 5 |
| ? New, executed in the FY | 1 | 0 | 1 | 1 | 2 |
| - Material transfer licenses (inventions), total active | 0 | 0 | 0 | 0 | 0 |
| ? New, executed in the FY | 0 | 0 | 0 | 0 | 0 |
| - Other invention licenses, total active in the FY | 0 | 0 | 0 | 0 | 0 |
| ? New, executed in the FY | 0 | 0 | 0 | 0 | 0 |
| ? **Other IP licenses**, total active in the FY | 0 | 0 | 0 | 0 | 0 |
| ? New, executed in the FY | 0 | 0 | 0 | 0 | 0 |
| - Copyright licenses (fee bearing) | | | | | |
| ? New, executed in the FY | | | | | |
| - Material transfer licenses (non-inventions), total active | | | | | |
| ? New, executed in the FY | | | | | |
| - Other, total active in the FY | | | | | |
| ? New, executed in the FY | | | | | |

Figures for FY 2003 are estimates at time of this report.

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

(1) "Active" = legally in force at any time during the FY.
(2) Patent license tally includes patent applications which are licensed.

### Profile of Active Licenses (cont.)

| | FY 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|
| ? **All income bearing licenses**, total number | 1 | 1 | 2 | 3 | 5 |
| ? Exclusive | 1 | 1 | 1 | 1 | 1 |
| ? Partially exclusive | 0 | 0 | 0 | 0 | 0 |
| ? Non-exclusive | 0 | 0 | 1 | 2 | 4 |
| ? **Invention licenses**, income bearing | 1 | 1 | 2 | 3 | 5 |

| | FY 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|
| ? Exclusive | 1 | 1 | 1 | 1 | 1 |
| ? Partially exclusive | 0 | 0 | 0 | 0 | 0 |
| ? Non-exclusive | 0 | 0 | 1 | 2 | 4 |
| - Patent licenses,(1) income bearing | 1 | 1 | 2 | 3 | 5 |
| ? Exclusive | 1 | 1 | 1 | 1 | 1 |
| ? Partially exclusive | 0 | 0 | 0 | 0 | 0 |
| ? Non-exclusive | 0 | 0 | 1 | 2 | 4 |
| ? **Other IP licenses**, income bearing | 0 | 0 | 0 | 0 | 0 |
| ? Exclusive | | | | | |
| ? Partially exclusive | | | | | |
| ? Non-exclusive | | | | | |
| - Copyright licenses (fee bearing) | | | | | |
| ? Exclusive | | | | | |
| ? Partially exclusive | | | | | |
| ? Non-exclusive | | | | | |
| ? **All royalty bearing licenses**,(2) total number | 1 | 1 | 2 | 3 | 5 |
| ? **Invention licenses**, royalty bearing | 1 | 1 | 2 | 3 | 5 |
| - Patent licenses,(1) royalty bearing | 1 | 1 | 2 | 3 | 5 |
| ? **Other IP licenses**, royalty bearing | 0 | 0 | 0 | 0 | 0 |
| - Copyright licenses (fee bearing) | | | | | |

Figures for FY 2003 are estimates at time of this report.

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

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

(1) Patent license tally includes patent applications which are licensed.
(2) Note that royalties are one component of total license income.

## Licensing Management

| | FY 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|
| ? **Elapsed execution time**,(1) licenses granted in the FY | | | | | |
| ? **Invention licenses** | | | | | |
| ? Average , months | * | * | 6** | 8** | 5 |
| ? Minimum | | | | | n/a |
| ? Maximum | | | | | n/a |

| | FY 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|
| - Patent licenses [2]<br>? Average, months<br>? Minimum<br>? Maximum | * | * | 6** | 8** | 5<br>n/a<br>n/a |
| ? **Licenses terminated for cause**, number in the FY | | | | | |
| ? Invention licenses | 0 | 0 | 0 | 0 | 0 |
| - Patent licenses [2] | 0 | 0 | 0 | 0 | 0 |

Figures for FY 2003 are estimates at time of this report.

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

* No new licenses were executed in FY 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 | FY 2003 |
|---|---|---|---|---|---|
| ? **Total income**, all licenses active in the FY [1] | $100 | $100 | $1,600 | $9,402 | $4,716 |
| ? **Invention licenses** | $100 | $100 | $1,600 | $9,402 | $4,716 |
| - Patent licenses [2] | $100 | $100 | $1,600 | $9,402 | $4,716 |
| ? **Other IP licenses**, total active in the FY | 0 | 0 | 0 | 0 | 0 |
| - Copyright licenses | | | | | |
| | | | | | |
| ? **Total Earned Royalty Income** (ERI) [3] | $100 | $100 | $1,600 | $9,402 | $4,716 |
| ? Median ERI | | | $800 | $1,333 | $696 |
| ? Minimum ERI | | | $100 | $100 | $100 |
| ? Maximum ERI | | | $1,500 | $7,969 | $4,716 |
| ? ERI from top 1% of licenses | | | $16 | $94 | $472 |
| ? ERI from top 5% of licenses | | | $80 | $470 | $236 |
| ? ERI from top 20% of licenses | | | $320 | $1,800 | $943 |
| ? **Invention licenses** | $100 | $100 | $1,600 | $9,102 | $4,716 |
| ? Median ERI | | | $800 | $1,333 | $696 |
| ? Minimum ERI | | | $100 | $100 | $100 |
| ? Maximum ERI | | | $1,500 | $7,969 | $4,716 |
| ? ERI from top 1% of licenses | | | $16 | $94 | $472 |
| ? ERI from top 5% of licenses | | | $80 | $470 | $236 |

| | FY 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|
| ? ERI from top 20% of licenses | | | $320 | $1,800 | $943 |
| - Patent licenses [2] | $100* | $100* | $1,600 | $9,102 | $4,716 |
| ? Median ERI | | | $800 | $1,333 | $696 |
| ? Minimum ERI | | | $100 | $100 | $100 |
| ? Maximum ERI | | | $1,500 | $7,969 | $4,716 |
| ? ERI from top 1% of licenses | | | $16 | $94 | $472 |
| ? ERI from top 5% of licenses | | | $80 | $470 | $236 |
| ? ERI from top 20% of licenses | | | $320 | $1,800 | $943 |
| ?**Other IP licenses**, total active in the FY | 0 | 0 | 0 | 0 | 0 |
| ? Median ERI | | | | | |
| ? Minimum ERI | | | | | |
| ? Maximum ERI | | | | | |
| ? ERI from top 1% of licenses | | | | | |
| ? ERI from top 5% of licenses | | | | | |
| ? ERI from top 20% of licenses | | | | | |
| - Copyright licenses | | | | | |
| ? Median ERI | | | | | |
| ? Minimum ERI | | | | | |
| ? Maximum ERI | | | | | |
| ? ERI from top 1% of licenses | | | | | |
| ? ERI from top 5% of licenses | | | | | |
| ? ERI from top 20% of licenses | | | | | |

Figures for FY 2003 are estimates at time of this report.

(1) Total income includes license issue fees, earned royalties, minimum annual royalties, paid-up license fees, and reimbursement for full-cost recovery of goods and services provided by the lab to the licensee including patent costs.
(2) Patent license tally includes patent applications which are licensed.
(3) "Earned royalty" = royalty based upon use of a licensed invention (usually, a percentage of sales or of units sold). Not a license issue fee or a minimum royalty.

* In FY 1999 and 2000, 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 | FY 2003 |
|---|---|---|---|---|---|
| ? **Income distributed**[(1)] | | | | | |
| ?**Invention licenses**, total distributed | $100 | $100 | $1,600 | $9,402 | $4,716 |
| - To inventor(s) | 0 (0%) | 0 (0%) | $1,500 (94%) | $696 (7%) | $1,130 (24%) |
| - To other | $100 (100%) | $100 (100%) | $100 (6%) | $8,706 (93%) | $3,586 (76%) |
| - Patent licenses,[(1)] total distributed | $100 | $100 | $1,600 | $9,402 | $4,716 |
| - To inventor(s) | 0 (0%) | 0 (0%) | $1,500 (94%) | $696 (7%) | $1,130 (24%) |
| -To other | $100 (100%) | $100 (100%) | $100 (6%) | $8,706 (93%) | $3,586 (76%) |

Figures for FY 2003 are estimates at time of this report.

Invention licenses are the chief policy interest in regard to income disposition. This table reflects this focus.

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

## ¦ Other Performance Measures Deemed Important by the Agency

*PC Magazine* selected the NOAA home page as one of this year's "100 Top Undiscovered Web Sites." NOAAs is the only federal government website listed in the top 100. The NOAA home page has over 275 million users. It is the starting point for people to find the latest information on the weather, climate, oceans, and space. For instance, millions of users turned to the NOAA home page during severe weather events, such as hurricanes like Isabel, tornadoes, and snowstorms. Users also find technology like satellite imagery of Iraq, whale songs, a tour of an undersea habitat, 7-day weather forecasts, market price of fish, and annual tidal predictions useful and/or interesting to their daily lives.

## ¦ Outcomes from Technology Transfer

- **Hurricane Isabel**. Without NOAA's excellent forecasts and end-to-end teamwork, Hurricane Isabel's toll on lives and property would have been even more devastating. NOAA's track forecast was outstanding. Isabel swept over the East Coast some 38 hours after well-positioned hurricane warnings and track forecasts had been issued. This is 14 possibly life-saving hours ahead of NOAA's 24-hour lead time goal. The Director and Deputy Director of NOAA's National Hurricane Center gave 180 broadcast interviews. National Hurricane Center staff handled an additional 280 phone interviews, plus another 45 in Spanish. On the Monday after, the Center Director briefed President Bush and several governors via video teleconference as they reviewed Isabel's wrath in a number of

states. Beginning with the President, kudos for NOAA's accuracy and endurance flowed in from throughout the Nation.

- **Improved hurricane forecasts**. NOAA's National Weather Service (NWS) announced it will begin issuing five-day hurricane forecasts, extending the three-day forecasts issued since 1964. NWS cited customer needs for longer-range forecasts and major improvements in track forecasting skill over the past few decades as reasons for lengthening the forecasts. The new forecast is to move resources out of harms way, such as U.S. Navy ships. The decision to extend the forecasts came after two years of successful testing with data from the 2001 and 2002 seasons, indicating the five-day track forecast will be as accurate as the three-day forecast was 15 years ago.

- **Tornado warnings save lives**. NOAA and our Nation owe a heartfelt thanks to the many dedicated men and women in the National Weather Service who worked tirelessly during the May 4-10 outbreak of severe weather. Early reports indicated that about 400 tornadoes hit 10 central and southern U.S. states during this record-breaking week. The preliminary average lead time provided for all tornado events is about 19 minutes - well above our current 11 minute performance goal. During this period, NOAA staff residing in these hard-hit communities literally lived in their offices, working to save lives rather than returning home to their own families. Undoubtedly the tragic loss of life would have been even higher without the front-line commitment of so many NOAA staff. On May 8, for example, a severe weather forecast briefing was broadcast live over NOAA Weather Radio transmitters in the Oklahoma City area – nearly three hours before tornadoes hit. Heavily promoted among local media and emergency managers, the briefing carried up-to-the-minute information on timing, location and expected impact. Tornado safety rules and preparedness were highlighted in the briefing. Then, as an F4 tornado tore through heavily populated areas in and around Oklahoma City, our forecasters broadcast continuing live updates of the storm's track on NOAA Weather Radio. Listeners phoned and e-mailed our Norman Forecast Office with thanks for outstanding service, and Oklahoma Governor Henry issued praise for the advance notice that saved lives. Missouri Governor Holden expressed appreciation as well.

- **Electronic commerce and print-on-demand for nautical charts**. The Office of Coast Survey, National Ocean Service and OceanGrafix collaborated in a CRADA to build Print on Demand/e-commerce for NOAA's suite of 1,000+ nautical charts. This technology prints charts only when ordered, and from digital files that NOAA updates daily. Electronic commerce software controls the automatic assembly and printing of ordered charts from digital files. The CRADA furthered NOAA's mission by providing mariners with nautical charts that are up-to-date with all critical corrections, a federal requirement for regulated vessels. Further, the transferred technology permits the customization of charts; eliminates inventory, warehouses, and the wasteful disposal of obsolete charts thus reducing costs; and eliminates labor and errors in order taking and fulfilling. The most important result will be improved safety and efficiency of marine transportation, and the protection of life, property, and the marine environment.

- **Public release of atmosphere and ocean models and model output**. The Geophysical Fluid Dynamics Laboratory (GFDL) has released several Earth System model components and model data to the public and university collaborators. A new Atmospheric Model (AM2) has been released to university collaborators the latest versions of the Modular Ocean Model (MOM4), an ocean model expressed in isopycnal coordinates (HIM), and the Flexible Modeling System (FMS) infrastructure

on which these models are based have been released and are available at http://nomads.gfdl.noaa.gov/. Model output from several experimental programs at GFDL, including Decadal-Centennial Coupled Climate and Ocean Data Assimilation are also available. There have been downloads to over 10,000 distinct hosts, including over 720 for MOM, almost 600 for HIM, and almost 800 for the FMS infrastructure. Nearly a terabyte of data has been requested.

· **Web-based access to distributed data sets**. The Pacific Marine Environmental Laboratory (PMEL) has transferred Live Access Server (LAS) software for web-based browsing (visualization) and downloading (subsetting) of earth science data sets to a broad scientific community. LAS presents geographically distributed data sets as a unified virtual data base. It is compatible with scientific data networking provided by the Open Source Project for a Network Data Access Protocol (OPeNDAP, formerly known as DODS). PMEL promoted the use of LAS throughout the Nation and the world. There are approximately 50 installations of LAS in research institutions spanning, NOAA, NASA, the U. S. Navy, Department of Energy, and national and international research institutions, such as the National Center for Atmospheric Research, the Monterey Bay Aquarium, the British Atmospheric Data Center and the Centre National de la Recherche Scientifique.

· **Scientific Graphics Toolkit and ncBrowse**. The Pacific Marine Environmental Laboratory (PMEL) has developed Java-based tools to more easily visualize oceanographic (and other) data for both web-based and desktop applications. The Scientific Graphics Toolkit (SGT) is designed to aid developers in producing scientific graphics applications. SGT has found a large international audience with over 5800 sites from 70 countries having downloaded the toolkit. The ncBrowse is a general purpose Java desktop application designed to enable users to interactively browse and visualize data from netCDF files and OPeNDAP resources. NetCDF is a file format that is commonly used by the oceanographic community to store both observations and model results. The ncBrowse has also found an international and cross-discipline audience with users from over 4000 sites from 60 countries downloading the application. The ncBrowse is included with the Precision Agricultural-Landscape Modeling System (PALMS) distribution from the University of Wisconsin-Madison and the International Oceanographic Data and Information Exchange (IODE) Ocean Teacher Data Management Resource Kit.

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

## *Technology Transfer at the Agency's Federal Laboratories – Approach and Plans, FY 2003 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 2003, 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. A beta version of the software has been requested by more than 200 parties for testing purposes and commercial licensing negotiations have begun with one U.S. corportation.

**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 2003, ITS continued its technical leadership and contributions to communications standards for public safety, particularly for first responders. ITS' primary area of contribution has been interoperability standards and testing procedures. ITS' objective video quality measurement method has been made a national standard by ANSI. ITS' method was also the best performing metric in comparison testing by the ITU with other methods from around the world.

# II. Performance in FY 2003: Activities and Achievements

## ¦ Collaborative Relationships for Research & Development

| | FY 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|
| ? **CRADAs**, total active in the FY [1] | -- | -- | 65 | 63 | 239 |
| - New, executed in the FY | -- | -- | -- | 6 | 178 |
| ? Traditional CRADAs,[2] total active in the FY | 6 | 3 | 6 | 6 | 5 |
| - New, executed in the FY | 4 | 3 | 1 | 0 | 0 |
| ? Non-traditional CRADAs,[3,4] total active in FY | -- | -- | 59 | 57 | 234 |
| - New, executed in the FY | -- | -- | -- | 6 | 178 |
| ? **Other types of collaborative R&D relationships** | | | | | |
| ? Collaborative standards contributions,[5] total active in FY | -- | -- | 3 | 3 | 2 |
| -New, executed in the FY | -- | -- | 3 | 0 | 1 |

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 2003, ITS worked collaboratively with Tektronix to produce an updated report for assessing the accuracy and cross-calibration of video quality metrics. ITS also collaborated with other researchers to produce a number of papers for the featured topic of IP network quality of service.

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 | FY 2003 |
|---|---|---|---|---|---|
| ? New inventions disclosed in the FY [1] | 0 | 0 | 1 | 0 | 0 |
| ? Patent applications filed in the FY [2] | 1 | 0 | 0 | 1 | 0 |
| ? Patents issued in the FY | 0 | 2 | 0 | 0 | 1 |
| ? Active patents, end of the FY | 3 | 5 | 5 | 5 | 6 |

(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 | FY 2003 |
|---|---|---|---|---|---|
| ? **All licenses**, number total active in the FY [1] | 1 | 2 | 2 | 3 | 57 |
| ? New, executed in the FY | 0 | 1 | 0 | 2 | 54 |
| ? **Invention licenses**, total active in the FY | 1 | 2 | 2 | 3 | 57 |
| ? New, executed in the FY | 0 | 1 | 0 | 2 | 54 |
| - Patent licenses,[2] total active in FY | 1 | 2 | 2 | 3 | 57 |
| ? New, executed in the FY | 0 | 1 | 0 | 2 | 54 |
| - Material transfer licenses (inventions), total active | 0 | 0 | 0 | 0 | 0 |
| ? New, executed in the FY | 0 | 0 | 0 | 0 | 0 |
| - Other invention licenses,[3] total active in the FY | 0 | 0 | 0 | 0 | 0 |
| ? New, executed in the FY | 0 | 0 | 0 | 0 | 0 |
| ? **Other IP licenses**, total active in the FY | 0 | 0 | 0 | 0 | 0 |
| ? New, executed in the FY | 0 | 0 | 0 | 0 | 0 |
| - Copyright licenses (fee bearing) | | | | | |
| ? New, executed in the FY | | | | | |
| - Material transfer licenses (non-inventions), total active | | | | | |
| ? New, executed in the FY | | | | | |
| - Other,[3] total active in the FY | | | | | |
| ? New, executed in the FY | | | | | |

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

(1) "Active" = legally in force at any time during the FY.
(2) Patent license tally includes patent applications which are licensed.

**Profile of Active Licenses (cont.)**

| | FY 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|
| ? **All income bearing licenses**, total number | 1 | 1 | 1 | 3 | 3 |
| ? Exclusive | 0 | 0 | 0 | 0 | 0 |
| ? Partially exclusive | 0 | 0 | 0 | 0 | 0 |
| ? Non-exclusive | 1 | 1 | 1 | 3 | 3 |
| ? **Invention licenses**, income bearing | 1 | 1 | 1 | 3 | 3 |
| ? Exclusive | 0 | 0 | 0 | 0 | 0 |
| ? Partially exclusive | 0 | 0 | 0 | 0 | 0 |
| ? Non-exclusive | 1 | 1 | 1 | 3 | 3 |
| - Patent licenses,(1) income bearing | 1 | 1 | 1 | 3 | 3 |
| ? Exclusive | 0 | 0 | 0 | 0 | 0 |
| ? Partially exclusive | 0 | 0 | 0 | 0 | 0 |
| ? Non-exclusive | 1 | 1 | 1 | 3 | 3 |
| ? **Other IP licenses**, income bearing | 0 | 0 | 0 | 0 | 0 |
| ? Exclusive | | | | | |
| ? Partially exclusive | | | | | |
| ? Non-exclusive | | | | | |
| - Copyright licenses (fee bearing) | | | | | |
| ? Exclusive | | | | | |
| ? Partially exclusive | | | | | |
| ? Non-exclusive | | | | | |
| ? **All royalty bearing licenses**,(2) total number | 1 | 1 | 1 | 0 | 0 |
| ? **Invention licenses**, royalty bearing | 1 | 1 | 1 | 0 | 0 |
| - Patent licenses,(1) royalty bearing | 1 | 1 | 1 | 0 | 0 |
| ? **Other IP licenses**, royalty bearing | 0 | 0 | 0 | 0 | 0 |
| - Copyright licenses (fee bearing) | | | | | |

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

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

(1) Patent license tally includes patent applications which are licensed.
(2) Note that royalties are one component of total license income.

**Licensing Management**

| | FY 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|
| ? **Elapsed execution time**,[1] licenses granted in the FY | | | | | |
| ? **Invention licenses** | | | | | |
| ? Average (or median), months | * | 6** | * | 5** | 1 |
| ? Minimum | | | | | 1 |
| ? Maximum | | | | | 1 |
| - Patent licenses [2] | | | | | |
| ? Average (or median), months | * | 6** | * | 5** | 1 |
| ? Minimum | | | | | 1 |
| ? Maximum | | | | | 1 |
| ? **Licenses terminated for cause**, number in the FY | | | | | |
| ? **Invention licenses** | 0 | 0 | 0 | 0 | 0 |
| - Patent licenses [2] | 0 | 0 | 0 | 0 | 0 |

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

*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 | FY 2003 |
|---|---|---|---|---|---|
| **? Total income, all licenses active in the FY** [1] | $10,982 | $63,693 | $5,000 | $65,470 | $0 |
| ? **Invention licenses** | $10,982 | $63,693 | $5,000 | $65,470 | $0 |
| - Patent licenses [2] | $10,982 | $63,693 | $5,000 | $65,470 | $0 |
| ? **Other IP licenses**, all active licenses in FY | $0 | $0 | $0 | $0 | $0 |
| - Copyright licenses | | | | | |
| | | | | | |
| ? **Total Earned Royalty Income** (ERI) [3] | $10,982 | $63,693 | $0 | $0 | $0 |
| ? Median ERI | | | | | |
| ? Minimum ERI | | | | | |
| ? Maximum ERI | | | | | |
| ? ERI from top 1% of licenses | | | | | |
| ? ERI from top 5% of licenses | | | | | |
| ? ERI from top 20% of licenses | | | | | |
| ? **Invention licenses** | $10,982 | $63,693 | $0 | $0 | $0 |
| ? Median ERI | | | | | |

| | FY 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|
| ? Minimum ERI | | | | | |
| ? Maximum ERI | | | | | |
| ? ERI from top 1% of licenses | | | | | |
| ? ERI from top 5% of licenses | | | | | |
| ? ERI from top 20% of licenses | | | | | |
| - Patent licenses [2] | $10,982* | $63,693* | $0 | $0 | $0 |
| ? Median ERI | | | | | |
| ? Minimum ERI | | | | | |
| ? Maximum ERI | | | | | |
| ? ERI from top 1% of licenses | | | | | |
| ? ERI from top 5% of licenses | | | | | |
| ? ERI from top 20% of licenses | | | | | |
| ?**Other IP licenses**, total active in the FY | $0 | $0 | $0 | $0 | $0 |
| ? Median ERI | | | | | |
| ? Minimum ERI | | | | | |
| ? Maximum ERI | | | | | |
| ? ERI from top 1% of licenses | | | | | |
| ? ERI from top 5% of licenses | | | | | |
| ? ERI from top 20% of licenses | | | | | |
| - Copyright licenses | | | | | |
| ? Median ERI | | | | | |
| ? Minimum ERI | | | | | |
| ? Maximum ERI | | | | | |
| ? ERI from top 1% of licenses | | | | | |
| ? ERI from top 5% of licenses | | | | | |
| ? ERI from top 20% of licenses | | | | | |

(1) Total income includes license issue fees, earned royalties, minimum annual royalties, paid-up license fees, and reimbursement for full-cost recovery of goods and services provided by the lab to the licensee including patent costs.
(2) Patent license tally includes patent applications which are licensed.
(3) "Earned royalty" = royalty based upon use of a licensed invention (usually, a percentage of sales or of units sold). Not a license issue fee or a minimum royalty.

* 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 | FY 2003 |
|---|---|---|---|---|---|
| ? **Income distributed** [1] | | | | | |
| ?**Invention licenses**, total distributed | $10,982 | $63,693 | $5,000 | $65,470 | $0 |

| | FY 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|
| - To inventor(s) | $4,695 (43%) | $20,508 (32%) | $2,900 (58%) | $21,041 (32%) | |
| - To other [3] | $6,287 (57%) | $43,185 (68%) | $2,100 (42%) | $44,429 (68%) | |
| - Patent licenses,[2] total distributed | $10,982 | $63,693 | $5,000 | $65,470 | $0 |
| - To inventor(s) | $4,695 (43%) | $20,508 (32%) | $2,900 (58%) | $21,041 (32%) | |
| -To other [3] | $6,287 (57%) | $43,185 (68%) | $2,100 (42%) | $44,429 (68%) | |

Invention licenses are the chief policy interest in regard to income disposition. This table re flects this focus.

(1) Income includes royalties and other payments received during the FY.
(2) Patent license tally includes patent applications which are licensed.
(3) 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 | FY 2003 |
|---|---|---|---|---|---|
| Technical publications produced | 32 | 20 | 17 | 17 | 20 |

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

## ¦ Outcomes from Technology Transfer

- **Video quality metric.** ITS developed a superior method of measuring video quality objectively by machine that closely predicts the quality that subjective human views would perceive. The technology is covered by three patents owned by ITS/NTIA. In FY 2003, the ITS method was adopted by the ANSI as a U.S. national standard. In addition, the ITU tested a number of proposed video quality metrics from around the world and found the ITS method superior. It is anticipated that ITS' method will soon be an international standard.

ITS targeted this technology for commercial development, with the potential of producing a royalty income for the laboratory within one year. More than 200 copies of software implementing the method have been requested this FY for purposes of evaluation. Negotiations for a commercial license have begun with a U.S. corporation.

- **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 continues this work in FY 2003 through a CRADA with Lucent Technologies' Bell Laboratories to investigate smart antenna performance, a technology that is targeted to dramatically increase the capacity of wireless systems and, therefore, reduce the problem of spectrum crowding. This technology is 2 to 4 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 to radio propagation for LMDS. LMDS provides broadband wireless communications for business and residential applications. Systems have been deployed in the U.S. and a number of U.S. companies are exporting systems and services. Research into LMDS was conducted with Hewlett Packard, U.S. WEST, and Lucent Technologies.