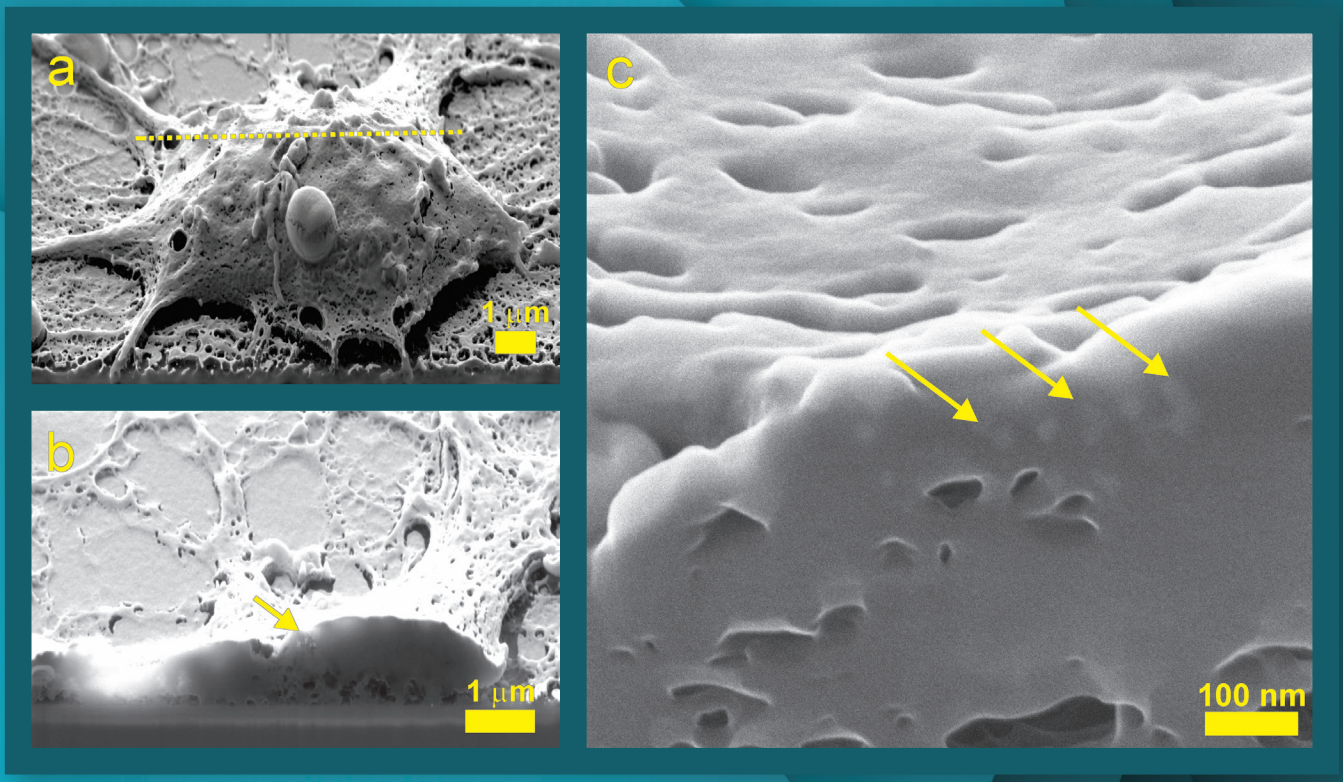
Federal Laboratory Technology Transfer

Fiscal Year 2012

Summary Report to the President and the Congress



Prepared by:

National Institute of Standards and Technology

U.S. Department of Commerce

December 2014

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Cover photo credit:

Title: *Nanoparticles in a Neural Cell*

Two PIF imaging tools enabled researchers to prove that the 30-nanometer gold particles were actually inside neural progenitor cells; a new capability. The micrograph at (a) shows the cell after exposure to the nanoparticles. A focused ion beam was used to mill away portions of the cell to reveal the interior. Researchers can mill an entire cell to reveal multiple cross-sections obtaining information about nanoparticle uptake. Image (b) shows a cutaway view of the cell corresponding to the dotted line in (a). The arrow points to a cluster of nanoparticles, which were then imaged with high resolution by a helium ion microscope (c), revealing nanoparticles (light-colored dots) near the cell membrane.

– Material Measurements Laboratory

Courtesy National Institute of Standards and Technology.
Credit: Jeerage/NIST 12/1/2014

FOREWORD

The Department of Commerce is pleased to submit this Fiscal Year 2012 Technology Transfer Summary Report to the President and the Congress. This report illustrates the continuing efforts of Federal laboratories to ensure that the Nation's investment in innovative research is transferred from our laboratories to the American people.

Federal laboratories, through their basic and mission-oriented research and development investments, have historically been at the forefront of scientific discovery, invention and technological innovation. Technology transfer facilitates the practical application of Federal research directly through the transfer of laboratory results and by providing non-federal entities opportunities to partner with Federal laboratories on innovative research of mutual interest. Over the years, new products, services, and the formation of new companies have occurred through technology transfer initiatives.

The Administration recognizes the importance of invention and technological innovation as drivers of economic growth and has challenged Federal laboratories to accelerate technology transfer operations over the next five years. This challenge was issued formally by the President on October 28, 2011, in the Memorandum for the Heads of Executive Departments and Agencies, entitled "Accelerating Technology Transfer and Commercialization of Federal Research in Support of High-Growth Businesses". This Presidential Memorandum reiterated the important role of innovation in accelerating the development of new industries, products, and services that lead to economic growth and job creation. In addition to directing agencies to accelerate technology transfer activities, it directed the Secretary of Commerce to improve and expand, where appropriate, the collection of metrics regarding the effectiveness of Federal technology transfer activities. This effort continues to be a major priority across agencies as described in the Lab-to-Market Cross-Agency Priority Goal in support of the President's Management Agenda issued in 2014. The present report will help serve as a baseline to measure progress toward achieving this ambitious challenge, while maintaining excellence in performing mission-focused research.

This report fulfills the requirement of Title 15 of the United States Code, Section 3710(g) (2), for an annual report summarizing the use of technology transfer authorities by Federal agencies. It highlights the achievements of Federal technology transfer and includes data on the use of specific transfer authorities. We will use future editions of this report to continue to keep the President and the Congress informed of the on-going efforts of Federal laboratories to expand our technology transfer efforts in partnership with U.S. industry; academic institutions; non-profit foundations; and state, local and tribal governments. These efforts will continue to play a vital role in building the Nation's economic strength.

Willie E. May
Acting Under Secretary of Commerce for Standards and Technology

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Chapter 1

Overview of Federal Technology Transfer

Many Federal agencies conduct research and development activities as part of their mission that often result in the creation of new information, innovations, and technologies. To make effective use of their resources, Federal agencies leverage their research activities by partnering with other Federal agencies, as well as many non-federal organizations in industry; academia; the non- profit sector; and state, local, and tribal governments. Through these partnerships, Federal agencies are better able to effectively develop and transform the results of their research from the bench scale in a laboratory to new products and services available in the marketplace. The transfer of federally developed information and technology to industry promotes economic growth and benefits society.

Federal agencies have a variety of legal authorities that are used to evaluate, protect, license, transfer, and monitor the utilization and commercialization of technologies. By making these technologies available to private, academic, and other government entities, Federal research and development (R&D) activities provide the United States a competitive edge in today's global market and improve the quality of life for all Americans.

This annual report summarizes the technology transfer and R&D activities of each of the eleven Federal agencies that have significant Federal laboratory operations:

- Department of Agriculture (USDA)
- Department of Commerce (DOC)
- Department of Defense (DoD)
- Department of Energy (DOE)
- Department of Health and Human Services (HHS)
- Department of Homeland Security (DHS)
- Department of the Interior (DOI)
- Department of Transportation (DOT)
- Department of Veterans Affairs (VA)
- Environmental Protection Agency (EPA)
- National Aeronautics and Space Administration (NASA)

Each of these agencies has established programs for promoting the transfer and commercialization of intellectual property developed in its R&D laboratories and has provided the data contained in this report. The Department of Commerce's National Institute of Standards and Technology (NIST) prepared and organized this report. An electronic version of this report is available at: http://www.nist.gov/tpo/publications/index.cfm.

Technology Transfer Principles and Approach

Promoting U.S. economic growth and creating jobs through the transfer and commercialization of federally developed technologies is a high priority for Federal laboratories. Collaborations between Federal agencies and non-federal organizations provide leverage that promotes more efficient and timely development of new technologies and facilitates the creation of new information and knowledge. These collaborations create better access to the results of Federal agency research and play an important role in the efficient and timely development of innovative technologies and new products.

Efficient technology transfer activities of Federal agencies ensure that taxpayer investments in research and development significantly benefit the domestic economy. Transferring research results, know-how, and rights to develop, refine, use, and market new technologies developed by Federal R&D laboratories reaps many benefits for the economy and for the health, safety, and welfare of the public. Since Federal research activities are often driven by agency-specific missions, technologies that are developed for a particular agency's use might otherwise be overlooked or go unused outside the agency without the dedicated efforts of Federal technology transfer offices, which promote the dissemination and utilization of these technologies.

Effective technology transfer promotes real economic growth through the development of new products, processes, medical treatments, services, and other benefits that serve a market need. The economic growth spurred by the transfer of Federal R&D creates a stronger job market, resulting from the manufacturing and marketing of new products and services. In addition to strengthening domestic and regional economies, successful partnerships with non-federal entities provide other benefits, including:

- Stimulating the flow of ideas between the Federal government and non-federal entities;
- Creating new businesses, especially small businesses;
- Attracting and retaining talented scientific personnel within Federal laboratories;
- Providing support to the mission of each agency;
- Accelerating the development of products and services and reducing the costs for these to reach the marketplace;
- Supporting further research by generating licensing revenue;
- Rewarding innovative accomplishments of Federal employee inventors through royalty sharing; and
- Creating a wide variety of new and efficient products in health care, defense, domestic security and many other sectors of the economy.

Federal Technology Transfer Summary

Technology transfer involves the transition of research from the laboratory into products and services into the economy. Federal legislation[1] provides a variety of vehicles through which technology developed with U.S. Government funds can be transferred to non-government entities in ways that benefit the Nation. These vehicles facilitate the potential commercialization of inventions produced from Federal funds, enable the use of Federal laboratory facilities by non-federal entities, and allow for the establishment of research partnerships between Federal laboratories and other entities. Federal legislation provides Federal agencies with the authorization to apply for patents or other forms of protection on inventions in which the Federal government owns a right, title, or interest. Federal agencies are also authorized to grant nonexclusive, exclusive, or partially exclusive licenses of patented, federally owned inventions. Agencies make the decisions to exercise these authorities within the context of their missions.

[1] The primary legislation addressing Federal technology transfer includes the Stevenson-Wydler Technology Innovation Act of 1980 (P.L. 96-480), Patent and Trademark Act Amendments of 1980 (P.L. 96-517) (Bayh-Dole Act), Small Business Innovation Development Act of 1982 (P.L. 97-219), Federal Technology Transfer Act of 1986 (P.L. 99-502), Omnibus Trade and Competitiveness Act of 1988 (P.L. 100-418), National Competitiveness Technology Transfer Act of 1989 (P.L. 101-189), American Technology Preeminence Act of 1991 (P.L. 102-245), Small Business Research and Development Enhancement Act of 1992 (P.L. 102-564), National Defense Authorization Act for Fiscal Year 1994 (P.L. 103-160), National Technology Transfer and Advancement Act of 1995 (P.L. 104-113), Technology Transfer Commercialization Act of 2000 (P.L. 106-404), Energy Policy Act of 2005 (P.L. 109-58), and the America COMPETES Act of 2007 (P.L. 110-69). Numerous other acts indirectly affect Federal technology transfer activities.

Every Federal agency that operates or directs one or more Federal laboratories, or that conducts research and development activities, is required to prepare and submit an annual report of its technology transfer activities as described in 15 U.S.C. § 3710(f). These reports contain details on each agency's technology transfer program and include agency plans to use technology transfer to advance the agency's mission and to promote U.S. competitiveness. The following figures and tables summarize Federal technology transfer activities for the five-year period from FY 2008 through FY 2012.[2]

Invention Disclosure and Patenting

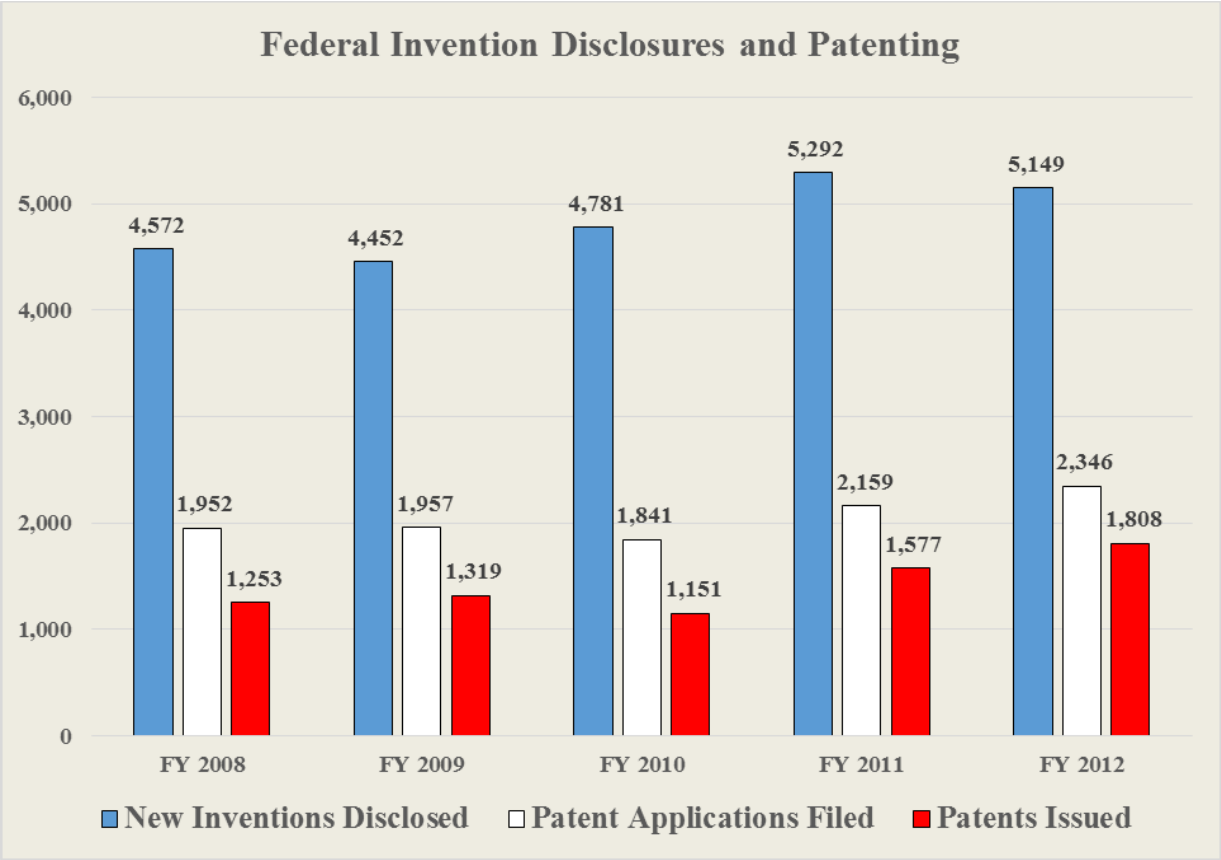
The protection of intellectual property can be vital to attracting the additional investment and product development resources necessary for early stage research products to be brought to their full commercial potential. Federal laboratory achievements in the areas of invention disclosures and patents obtained are often cited as metrics of the active management of intellectual assets and technical know-how by Federal agencies.

Between FY 2008 and FY 2012, the number of invention disclosures reported by Federal agencies increased by 13% to a total of 5,149 in FY 2012. The number of patent applications filed increased by 20% to 2,346, and the number of patents issued increased by 44% to 1,808.

DOE has reported the largest number of invention disclosures (1,661) for FY 2012, followed by NASA (1,582) and DoD (1,037). These three agencies accounted for 83% of all invention disclosures reported in this year.

DoD has reported the largest number of patent applications (888) and patents issued (667). DOE was second in both categories (780 and 483) and HHS was third (222 and 372). In FY 2012, these three agencies accounted for 81% of patent applications and 84% of patents issued.

[2] Technology transfer data are typically adjusted over time to account for new information resulting from changes in reporting procedures, patent decisions, programmatic changes, etc. Throughout this report, data prior to FY 2012 have been adjusted, where necessary, to reflect the most accurate estimates for each year reported.



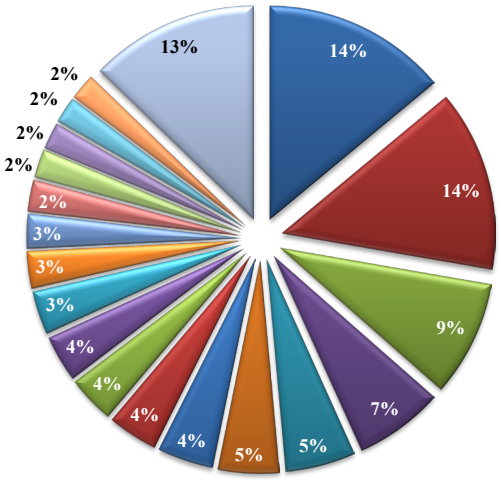
	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
New Inventions Disclosed	4,572	4,452	4,781	5,292	5,149
Patent Applications Filed	1,952	1,957	1,841	2,159	2,346
Patents Issued	1,253	1,319	1,151	1,577	1,808

Using data from the US Patent Office (USPTO), the technical areas covered by patents issued to Federal agencies in FY 2012 can be identified. The figure below shows the percentage of patents issued to Federal agencies by technology area based on a fractional count of patents.[3] In FY 2012, the technical area in which the most patents were obtained involved Biotechnologies.[4]

[3] For this study, patents are credited on a fractional-count basis (i.e., for patents with assignees from multiple Federal agencies, other U.S. institutions, or foreign institutions, each Federal agency receives fractional credit on the basis of the proportion of its participating institution(s)). Patents assigned by The Patent Board's technology area classification. Sources: National Science Foundation, National Center for Science and Engineering Statistics, and The Patent Board™, special tabulations (2013). Copyright 2013 © The Patent Board, used with permission.

[4] Definitions of all technology areas addressed are included in Appendix 1.

USPTO patents assigned to selected U.S. Federal agencies by technology area: FY 2012



- Biotechnology - 14%
- Measurement Techniques & Instrumentation - 14%
- Aerospace & Defense - 9%
- Information Processing - 7%
- Telecommunications - 5%
- Materials Manufacturing - 5%
- Semiconductors - 4%
- Optics - 4%
- Materials - 4%
- Power Generation & Distribution - 4%
- Pharmaceuticals - 3%
- Chemicals - 3%
- Electronic Components & Devices - 3%
- Medical Electronics - 2%
- Chemical Engineering & Environmental Processes - 2%
- Agriculture - 2%
- Automation & Control - 2%
- Medical Equipment - 2%
- Other - 13%

Licensing

Licensing of federally developed technologies is one of the primary mechanisms used to create incentives for industry to invest the resources necessary to develop and commercialize nascent leading-edge technologies. Successful development and commercialization creates benefits to the economy and contributes to competitiveness and domestic economic growth. The ability to grant licenses to the non-federal sector to develop and commercialize government-owned technologies helps promote federally developed innovations, which would otherwise not be further developed into commercial products or services. The terms and conditions under which Federal intellectual property is licensed vary based upon many factors, including the extent of development of the technology, the financial resources needed to further develop the technology for consumer use, fields of use, projected market impact, and other factors.

Between FY 2008 and FY 2012, the number of total active licenses reported by Federal laboratories increased by 5% to a total of 13,405 in FY 2012. The number of invention licenses declined slightly by 0.4%. The number of income-bearing licenses declined by 16%, while the number of exclusive licenses increased by 6% to a total of 1,092.

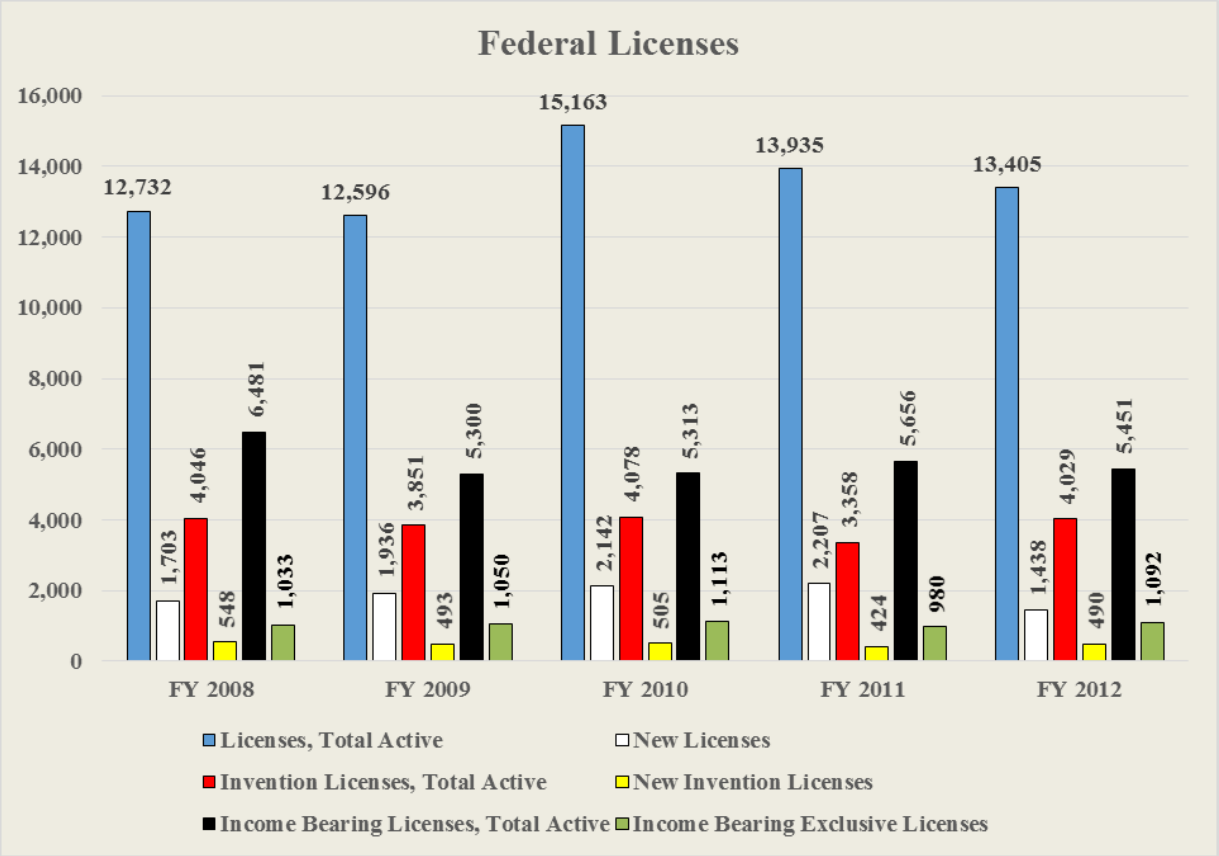
DOE reported the largest number of licenses (5,328), followed by NASA (4,870) and HHS (1,465). These three agencies accounted for 87% of all licenses reported in FY 2012.

DOE reported the largest number of invention licenses (1,428), followed by HHS (1,090) and NASA (434). Together these three agencies accounted for 73% of invention licenses.

DOE reported the largest number of income-bearing licenses (3,340) which was significantly higher than all other agencies combined. This number includes software licenses under copyright; however, while software is increasingly a key element of Federal laboratory R&D outputs, most other Federal agencies cannot copyright software developed by their employees.5 HHS was second (856) followed by USDA (379). Together these three agencies accounted for 84% of income-bearing licenses.

DOE reported the largest number of income-bearing exclusive licenses (344), followed by USDA (277) and HHS (135). Together these three agencies accounted for 69% of income-bearing exclusive licenses.

[5] Under 17 U.S.C. § 105, copyright protection is not available for any work of the United States Government.

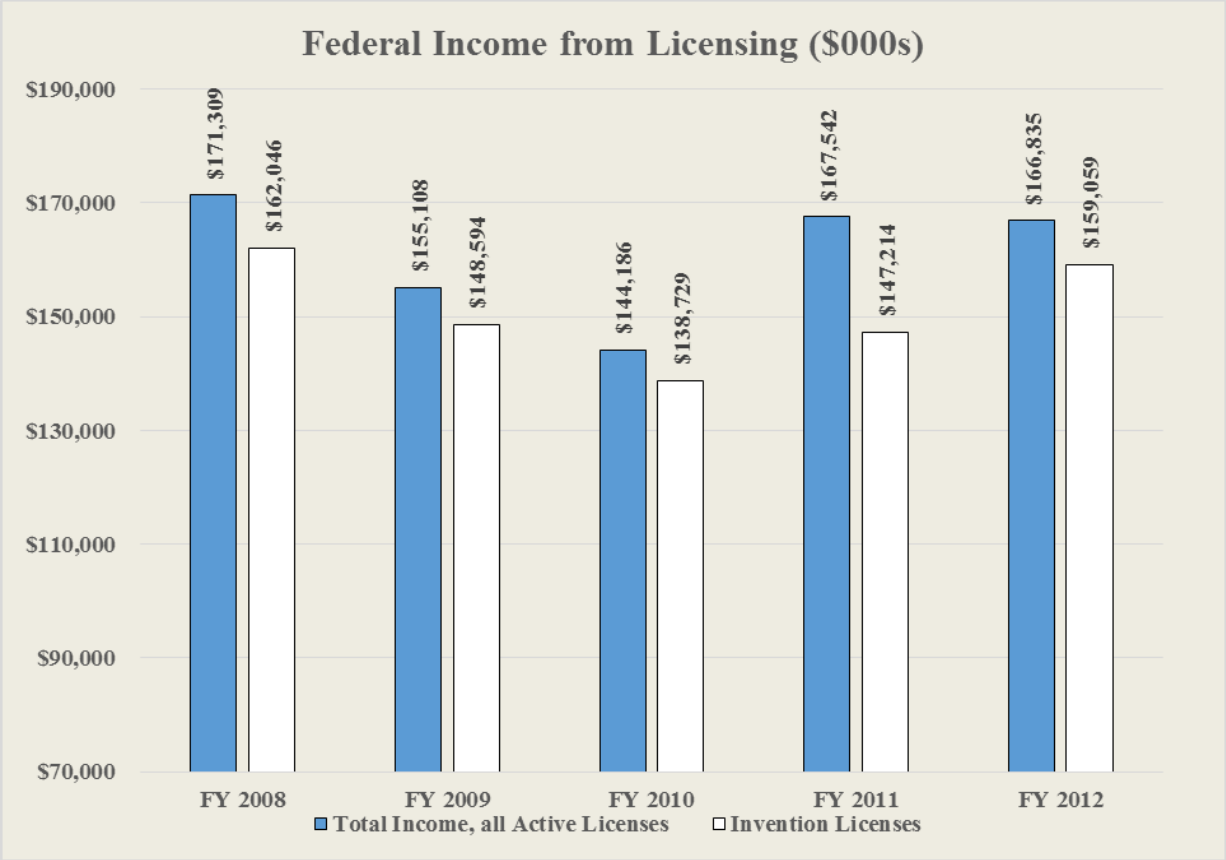


	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Licenses, Total Active	12,732	12,596	15,163	13,935	13,405
New Licenses	1,703	1,936	2,142	2,207	1,438
Invention Licenses, Total Active	4,046	3,851	4,078	3,358	4,029
New Invention Licenses	548	493	505	424	490
Income Bearing Licenses, Total Active	6,481	5,300	5,313	5,656	5,451
Income Bearing Exclusive Licenses	1,033	1,050	1,113	980	1,092

Licensing Income

Between FY 2008 and FY 2012, income from all licensing decreased by 3% to a total of $166.8 million. Income from invention licenses also declined over this period by 2% to a total of $159.1 million.

HHS accounted for the most licensing income in FY 2012 ($110.6 million) and the most invention licensing income ($108.3 million) followed by DOE ($40.9 million / $36.1 million), and DoD ($7.1 million / $6.6 million). Together these three agencies accounted for 95% of reported licensing income and 95% of reported income from invention licenses.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Total Income, all Active Licenses	$171,309	$155,108	$144,186	$167,542	$166,835
Invention Licenses	$162,046	$148,594	$138,729	$147,214	$159,059
Total Earned Royalty Income	$117,920	$112,020	$107,677	$115,606	$119,427

Collaborative Research and Development Relationships

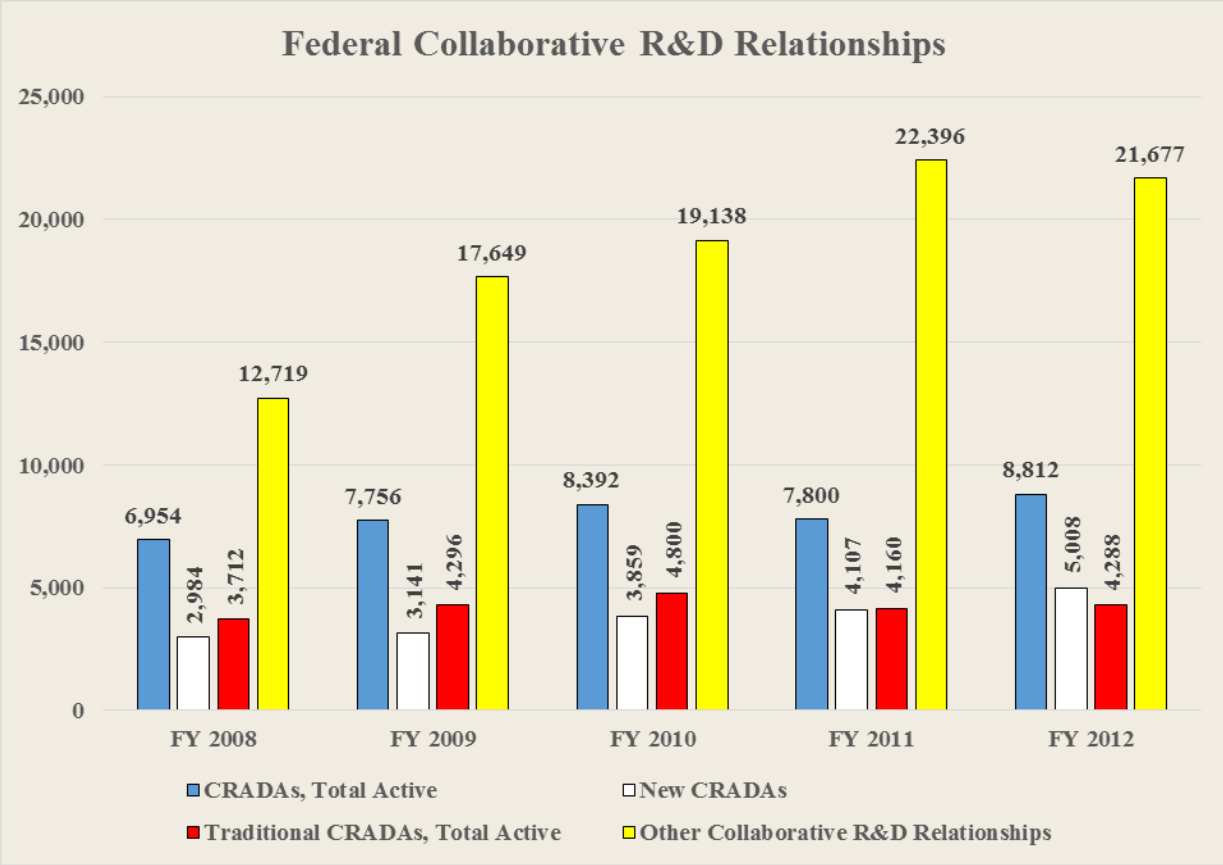
Collaborative research and development relationships between Federal laboratories and non-federal collaborators are widely viewed as an effective and economical means of transferring technology and promoting joint research. These relationships create a mutually advantageous leveraging of Federal agency and collaborator resources and technical capabilities, and they provide avenues for both the collaborator and the Federal laboratory to gain new competencies and develop new skills.

One frequently used mechanism for establishing joint research relationships is the Cooperative Research and Development Agreement (CRADA). The CRADA is a multifaceted mechanism that can be used to address several kinds of transfer and intellectual protection needs. A "traditional CRADA" refers to a formal collaborative research and development agreement between a Federal laboratory and non-federal partners. Other CRADA arrangements can address special purpose applications such as material transfer agreements or agreements that facilitate technical assistance activities that may yield information needing intellectual property protection.

In addition to CRADAs, many agencies have other specific authorities which also facilitate cooperative R&D relationships such as Space Act Agreements (NASA), guest researcher agreements, etc.

Between FY 2008 and FY 2012, the number of active CRADAs increased by 27% to a total of 8,812. During this period the number of traditional CRADAs increased by 16% to 4,288 and other collaborative R&D relationships increased by 70% to 21,677.

In FY 2012, DOC reported the largest number of CRADAs (2,934), followed by DoD (2,400) and VA (1,510). DoD reported the largest number of traditional CRADAs (1,328), followed by DOE (742) and HHS (206). USDA reported the largest number of other collaborative R&D relationships (14,351), NASA was second (4,245 Space Act Agreements), and DOC was third (2,782).



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
CRADAs, Total Active	6,954	7,756	8,392	7,800	8,812
New CRADAs	2,984	3,141	3,859	4,107	5,008
Traditional CRADAs, Total Active	3,712	4,296	4,800	4,160	4,288
Other Collaborative R&D Relationships	12,719	17,649	19,138	22,396	21,677

Improving Metrics

While the metrics summarized in this report demonstrate a robust use of technology transfer mechanisms, there has long been a desire to expand the types of metrics being gathered and by doing so, improve our ability to assess the impact of Federal technology transfer upon the economy. To this end, the Federal Interagency Working Group on Technology Transfer (IAWGTT)[6] routinely meets and discusses how technology transfer mechanisms and metrics can be improved. This group, which is comprised of agency leaders from across the Federal government, serves as a broad forum to identify and discuss best practices, better metrics, emerging concerns, and trends through dialogue, interagency comparisons, and experience-sharing. Through the IAWGTT, Federal agencies cooperatively discuss and review new and better means to improve both quantitative and qualitative measurements of technology transfer activities and other means to improve the dissemination of federally developed technologies.

More recently, an even greater emphasis has been given to the tasks of improving metrics and assessing technology transfer impacts. On October 28, 2011, the President issued a Presidential Memorandum (PM), "*Accelerating Technology Transfer and Commercialization of Federal Research in Support of High-Growth Businesses"*,[7] that calls on Federal agencies engaged in laboratory research to establish performance goals, metrics, evaluation methods, and implementation plans to improve the efficacy of Federal technology transfer activities. In response to this directive, Federal agencies have prepared and are currently implementing plans for improving the monitoring and assessment of their technology transfer operations.[8]

Beginning in Fiscal Year 2013, improvements implemented through Federal agency plans will also be presented in this annual technology transfer report.

It is anticipated that these new methods and metrics will present a broader multi-agency perspective of technology transfer and will contain more information on interactions with small businesses and other collaborative efforts that have the potential to spur scientific advances, discoveries, and innovations. These new methods and metrics will also provide better and more information to help inform future policy decision and enable Federal agencies to adjust and improve plans on a continuing basis.

Assessing Impact

The PM also calls on agencies to develop criteria to assess the effectiveness and impact of the Nation's economy of planned or future technology transfer efforts. Federal agencies have a long history of producing impact studies to justify budget initiatives to fund research projects and public services. For example, since 2000, NIST has conducted 16 economic impact studies that support a wide variety of laboratory research and standards programs.[9] These studies, which have focused on benefits attributed to test methods, calibration services, reference materials, and other services provided by NIST, show a combined benefit-to-cost ratio of 47:1, indicating significant economic impact flowing from the transfer of NIST knowledge and know-how to the marketplace.

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[6] Agencies participating in the IAWGTT, established pursuant to Executive Order 12591 of April 10, 1987, include USDA, DOC, DoD, DOE, HHS, DHS, DOI, DOT, VA, EPA, and NASA.

[7] See http://www.whitehouse.gov/the-press-office/2011/10/28/presidential-memorandum-accelerating-technology-transfer-and-commerciali

[8] In response to the PM, Federal agencies prepared plans for improving their technology transfer operations, which were submitted to the Office of Management and Budget and to the Office of Science and Technology Policy for review. These plans are available online at http://nist.gov/tpo/publications/agency-responses-presidential-memo.cfm

[9] See http://www.nist.gov/director/planning/summary-studies.cfm

Using a different approach, DoD recently published a study that assesses how Federal licensing agreements have contributed to new economic activity and job creation in the United States and how these licenses have resulted in the transition of new technologies to U.S. military use.[10] In this study, more than 500 companies, with a total of more than 600 license agreements with DoD during the 2000-2011 time periods, were surveyed to determine the total sales of new products and services directly related to their DoD license agreements. Economic-impact assessment software was then used to simulate economic activity and forecast how these licensing agreements would affect economic output, value added, employment, labor income, and tax revenues. Total economy-wide sales, as measured by output, were estimated at $36.3 billion. Value added was estimated at $17.4 billion, representing new wealth creation in the economy. Employment impacts included 163,067 jobs with an average wage of $65,000. Labor income in 2011 was estimated at $10.6 billion. The $13.4 billion in sales and its economy-wide effects generated approximately $2.3 billion in Federal tax revenues and over $1.3 billion in state and local tax revenues.

Similarly, a 2009 study commissioned by the Navy simulated the economic impact associated with 103 CRADA and licensing agreements between the Navy and the private sector, consisting predominately of companies and university partners.[11] The study estimated that the combined impact from these technology transfer mechanisms generated $345 million in additional regional economic activity, an additional $60 million in Federal, state, and local taxes, and were directly responsible for creating 670 jobs.

In order to get a more comprehensive understanding of what studies have been done, NIST recently commissioned a review of contemporary literature dealing with efforts to assess Federal technology transfer activities. This study, Technology Transfer Research and Evaluation: Implications for Federal Laboratory Practice, by Dr. Barry Bozeman, focuses on peer-reviewed studies published between 2000 and 2012 that assess the impact of technologies developed in and transferred from Federal laboratories.[12]

Of more than 200 technology transfer studies reviewed, only a third quantitatively assessed the impact of Federal technology transfer activities. These studies were grouped by four basic characteristics (who actually did the transfer, how they did it, what they transferred, and to whom the technology was transferred) and then analyzed according to a set of common traits including advantages and disadvantages of the approaches used. Dr. Bozeman's study thus catalogues the various approaches that have been used to assess economic impact and helps identify the most efficient approaches to use when designing future impact assessment studies of Federal technology transfer.

The IAWGTT will increase its efforts to evaluate the criteria for assessing economic impact and will coordinate efforts to promote best practices and approaches to assess the economic impact from Federal technology transfer activities. The results of these efforts will also be presented in future editions of this report.

[10] See http://static.techlinkcenter.org/techlinkcenter.org/files/economic-impacts/DoD-Economic-Impact-Final-2.13.pdf

[11] See http://www.ibrc.indiana.edu/studies/t2.pdf

[12] Dr. Bozeman is the Arizona Centennial Professor of Public Management and Technology Policy and Director of the Center of Organizational Research and Design at the School of Public Affairs, Arizona State University. This paper has recently been submitted for publication.

Chapter 2

Agency Performance in FY 2012

Each Federal research and development agency prepares and submits an annual report covering data on technology transfer as described in 15 U.S.C. § 3710(f). These reports include details on each agency's technology transfer program and plans to use technology transfer to advance the agency's mission and promote U.S. competitiveness.

This chapter provides a comparable summary of the content of these eleven Federal agency reports. Two main topic areas are addressed:

- Statistical data on the agency's technology transfer activity levels for a number of measures (e.g., cooperative research and development relationships, invention disclosure and patenting, and intellectual property licensing) for the most recently closed Fiscal Year (FY 2013) and several prior years (chiefly, FY 2008-2012); and
- Reported examples of successful downstream outcomes arising from the agency's technology transfer activities (such as new products or improved industrial processes available in the marketplace that arise from the transfer and commercialization of Federal lab inventions).

Department of Agriculture (USDA)

USDA broadly defines technology transfer as the adoption of research outcomes (i.e., solutions) for public benefit. These science-based innovations from USDA intramural research --- through these public/private partnerships --- create new or improved technologies, processes, products, and services that benefit the Nation by increasing productivity, increasing efficiency (keeping costs low), and enhancing global competitiveness for the U.S. agriculture sector. Thus, technology transfer functions are critical to accelerating utility of public R&D investments, creating economic activity, creating jobs, and sustaining economic development.

Principal among the formal instruments of technology transfer are Cooperative Research and Development Agreements (CRADAs), patents, and invention licenses for commercialization by the private sector, as well as material transfer agreements with industry. In addition to these formal instruments, technology transfer also occurs through publications, workshops, field days, press releases, and other conventional mechanisms. To assist USDA in transferring technologies to the private sector, the Agricultural Research Service (ARS) recently created the Agricultural Technology Innovation Partnership (ATIP) program to further enhance the likelihood that research outcomes will be adopted by the private sector for commercialization. ATIP members coordinate regional, co-sponsored events with USDA, showcasing available technologies for licensing, and USDA intramural research capabilities available to businesses to assist in solving high priority, mission-related issues connected to the agricultural industries. Additionally, ATIP members provide the current or prospective private sector partners of USDA with access to business mentors, entrepreneur schools, seed and venture funds, and to NIST Hollings Manufacturing Extension Partnership (MEP) program Centers.

The ARS has been delegated authority by the Secretary of Agriculture to administer the patent program for ARS, the review of CRADAs, and the technology licensing program for all intramural research conducted by USDA. This report covers technology transfer activities and metrics for the ARS, Forest Service (FS), Animal and Plant Health Inspection Service's Wildlife Services (APHISWS), Animal and Plant Health Inspection Service's Veterinary Services (APHIS-VS), Animal and Plant Health Inspection Service's Plant Protection and Quarantine (APHIS-PPQ), Animal and Plant Health Inspection Service's Biotechnology Regulatory Services (APHIS-BRS), Animal and Plant Health Inspection Service's International Services (APHIS-IS), National Institute of Food and Agriculture (NIFA), Economic Research Service (ERS), National Agricultural Statistics Service (NASS), Foreign Agricultural Service (FAS), Rural Development (RD), Agricultural Marketing Service (AMS), Grain inspection, Packers, and Stockyards Administration (GIPSA), Food Safety and Inspection Service (FSIS) and Natural Resources Conservation Service (NRCS).

More information about USDA's technology transfer activities is available on the following websites:

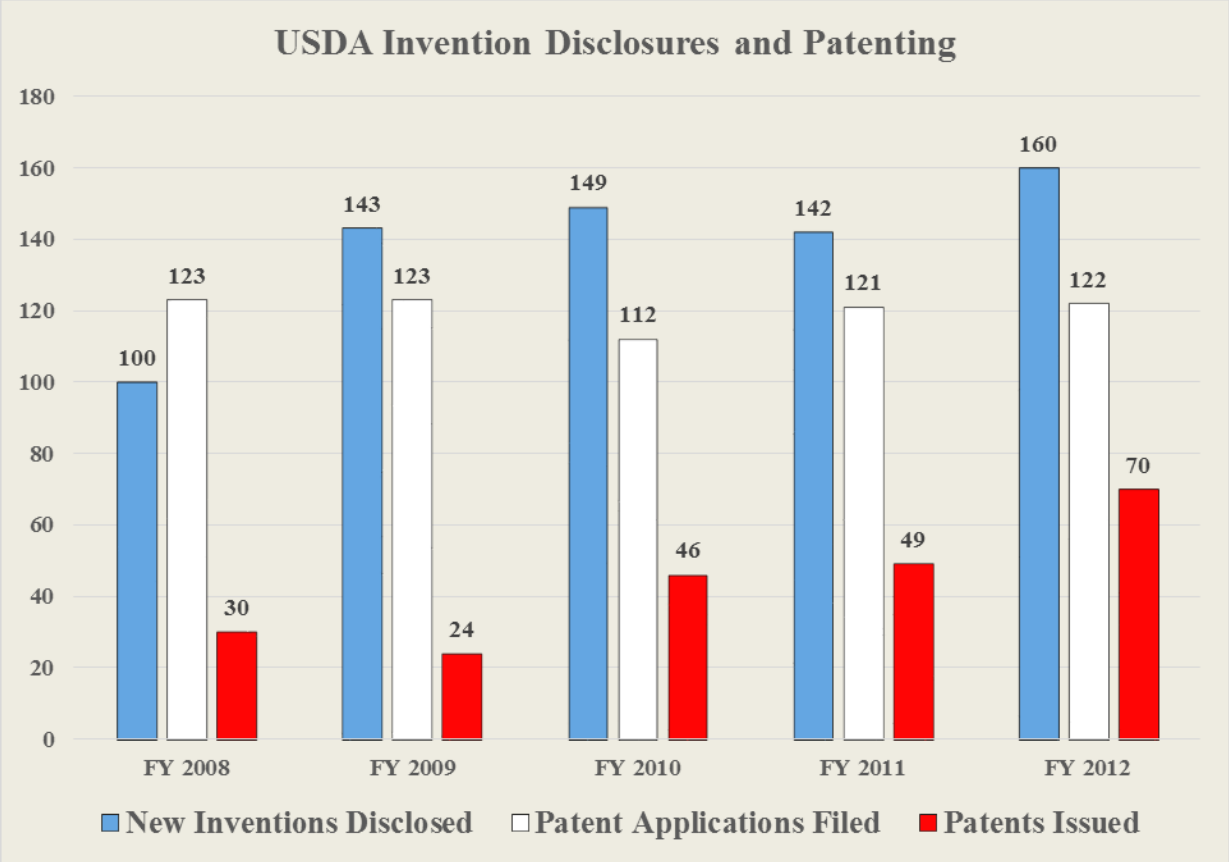
Agricultural Research Service: http://www.ars.usda.gov/partnering

Animal and Plant Health Inspection Service: http://www.aphis.usda.gov/wildlife_damage/nwrc/

Forest Service: http://www.fs.fed.us.

USDA Invention Disclosures and Patenting

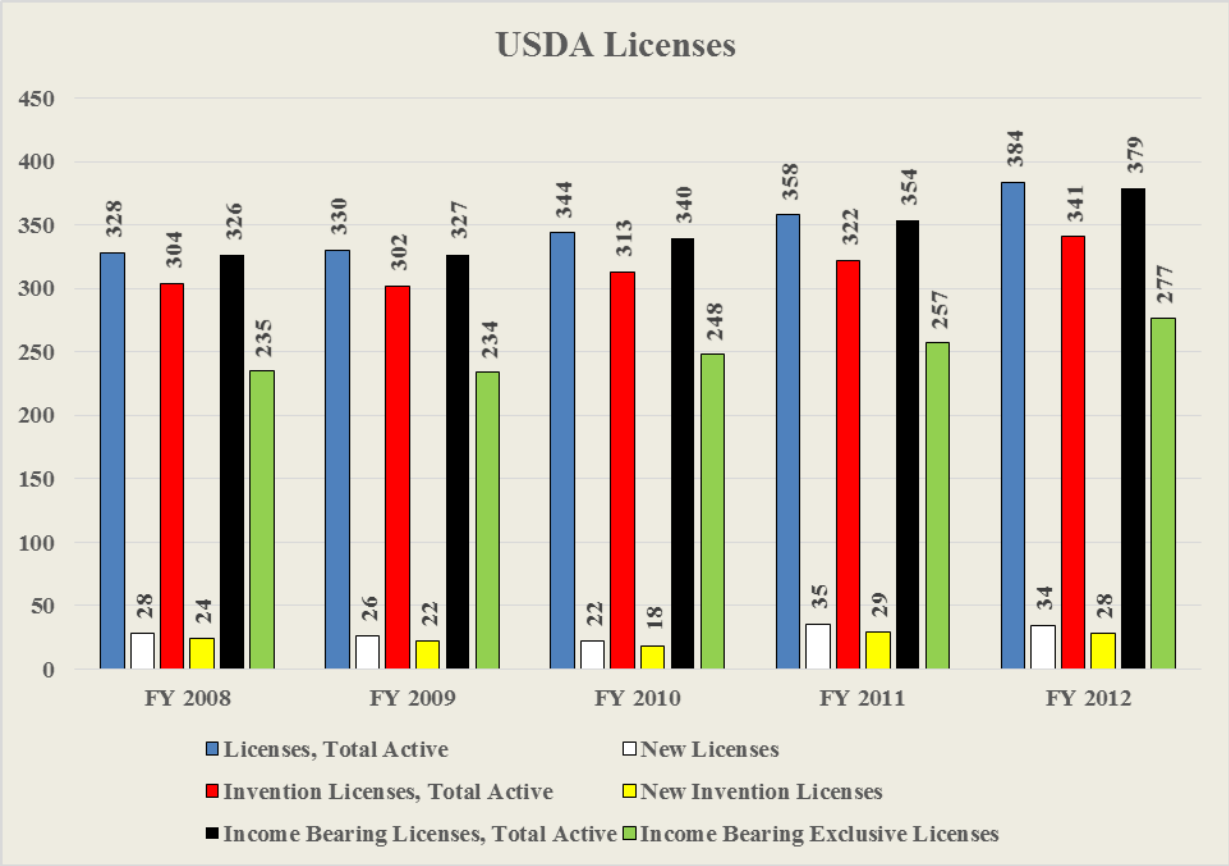
Between FY 2008 and FY 2012, the number of invention disclosures increased by 60% to a total of 160 in FY 2012. The number of patent applications has been relatively constant, declining by 1% to 122, while the number of patents issued has increased by 133% from 30 in FY 2008 to 70 in FY 2012.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
New Inventions Disclosed	100	143	149	142	160
Patent Applications Filed	123	123	112	121	122
Patents Issued	30	24	46	49	70

USDA Licenses

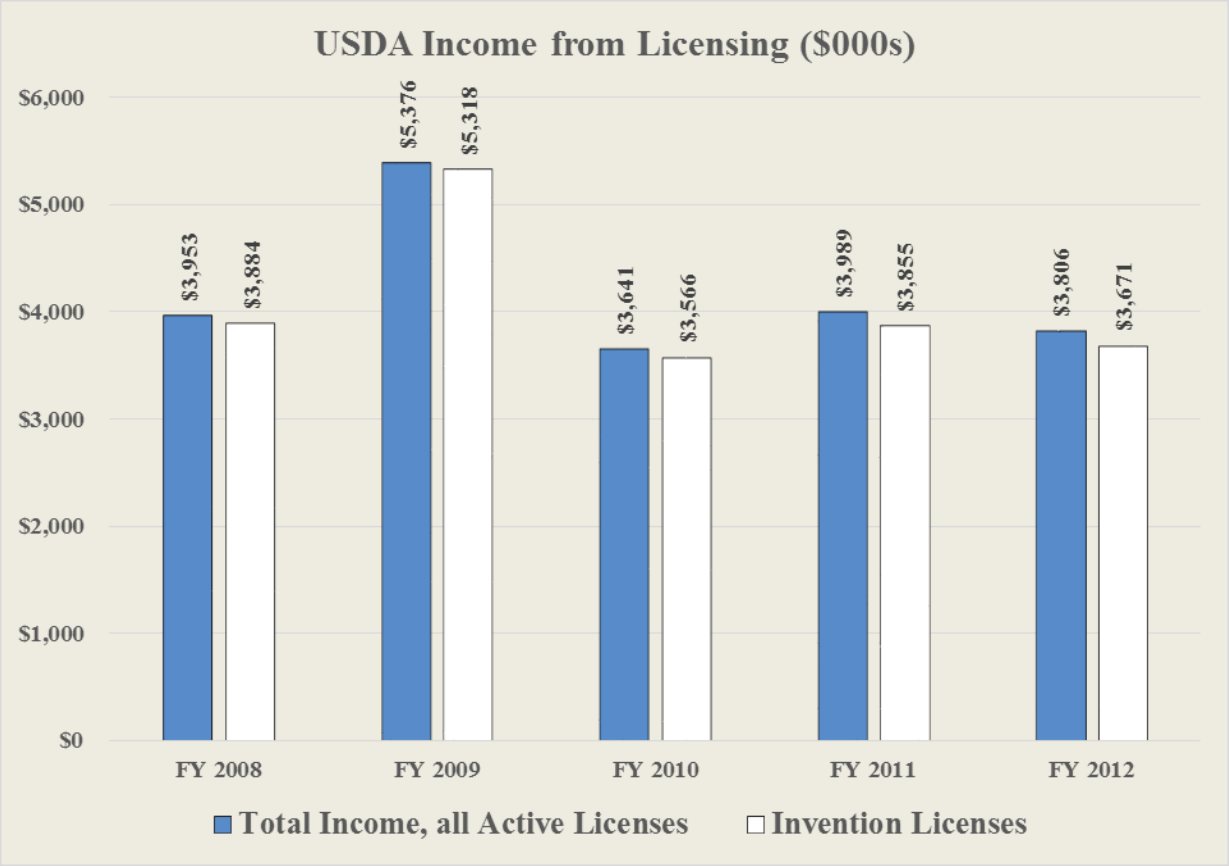
Between FY 2008 and FY 2012, the number of total active licenses increased by 17% to a total of 384 in FY 2012, while the number of invention licenses increased by 12% to 341. The number of income-bearing licenses increased by 16% to a total of 379, while the number of income-bearing, exclusive licenses increased by 18% to a total of 277.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Licenses, Total Active	328	330	344	358	384
New Licenses	28	26	22	35	34
Invention Licenses, Total Active	304	302	313	322	341
New Invention Licenses	24	22	18	29	28
Income Bearing Licenses, Total Active	326	327	340	354	379
Income Bearing Exclusive Licenses	235	234	248	257	277

USDA Income from Licensing

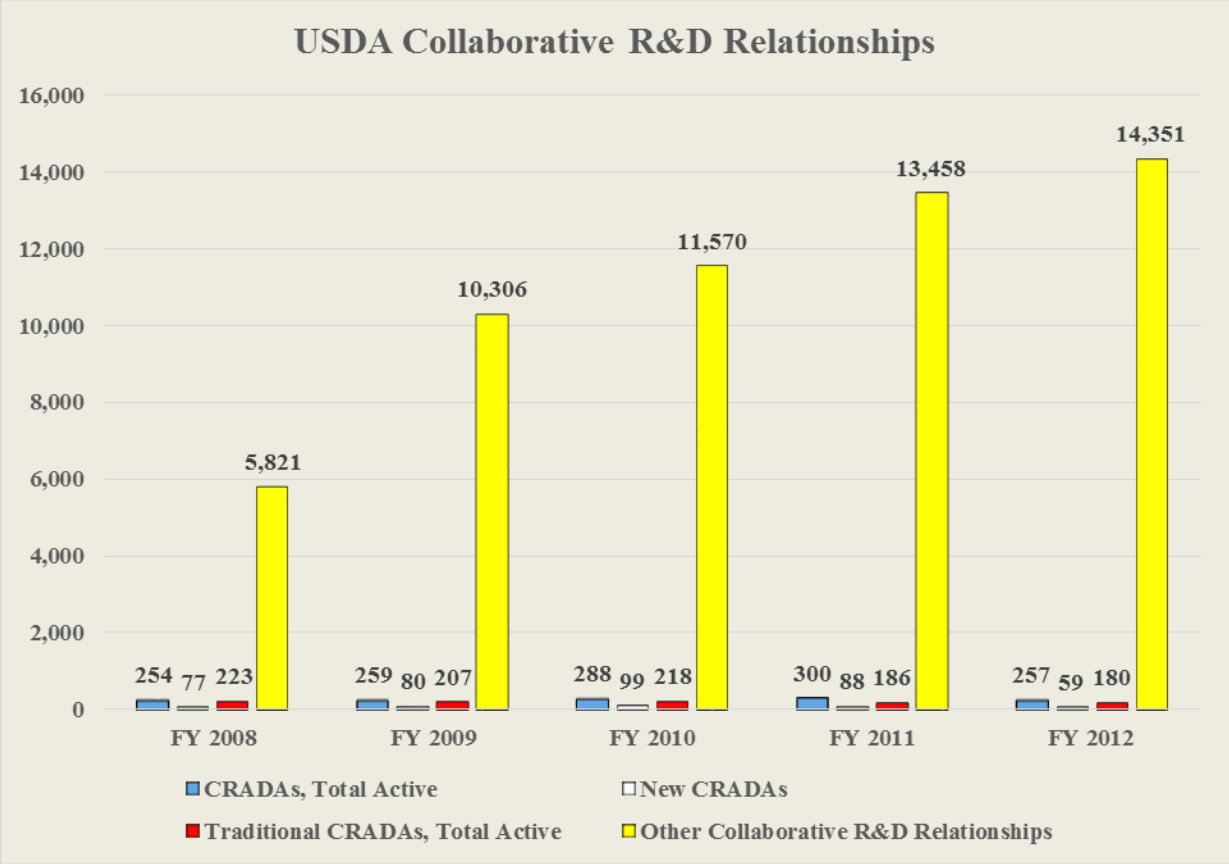
Between FY 2008 and FY 2012, income from all licensing decreased by 4% to a total of $3.81 million in FY 2012. Income from invention licenses also declined over this period by 5% to a total of $3.67 million.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Total Income, all Active Licenses	$3,953	$5,376	$3,641	$3,989	$3,806
Invention Licenses	$3,884	$5,318	$3,566	$3,855	$3,671

USDA Collaborative R&D Relationships

Between FY 2008 and FY 2012, the number of active CRADAs increased by 1% to a total of 257 in FY 2012. During this period, the number of traditional CRADAs declined by 19% to 180. Other collaborative R&D relationships increased by 147% to 14,351.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
CRADAs, Total Active	254	259	288	300	257
New CRADAs	77	80	99	88	59
Traditional CRADAs, Total Active	223	207	218	186	180
Other Collaborative R&D Relationships	5,821	10,306	11,570	13,458	14,351

Downstream Success Stories for USDA

Replacing Antibiotics in Young Swine Feed with Natural Alternatives

Antibiotics have been fed at sub-therapeutic levels as health, growth, and efficiency promoters for more than 50 years and much of the swine produced in the United States receives antibiotics in their feed at some point during the production process; however, because of concerns over antibiotic resistance, alternatives to antibiotics are a high priority for United States swine producers. ARS researchers determined that feeding a natural antimicrobial agent called lysozyme to young pigs consuming a liquid diet was as effective as antibiotics in increasing growth performance, improving gastrointestinal health, and decreasing pathogen shedding in feces. This natural antimicrobial agent is a suitable alternative to antibiotics for young pigs consuming manufactured liquid diets. The identification of suitable alternatives to antibiotics will enable the swine industry to effectively transition away from dietary antibiotic use. *Nutrition Research Unit and Meat Safety & Quality Research Unit, Clay Center, NE*

Continuous Monitoring of the Nutritional Content of Common U.S. Foods

Monitoring the nutritional content of the U.S. food supply has been a USDA priority since 1891. The nutrient data compiled by this USDA program are used as the basis for national and international food policy decisions that link food or nutrient intake to health or disease risk and are also the basic data used for many private food databases. ARS researchers from Beltsville, Maryland, have released the 24th version of the National Nutrient Database for Standard Reference. In addition to a focus on 7,500 foods and up to 140 nutrients, a special interest database on flavonoid content of foods was released that will allow researchers to study the potential health benefits of these compounds, found in fruits, vegetables, tea, and cocoa. These databases will update nutritional assessment of the U.S. food supply and will ensure that nutritional policy is made using the most up-to-date information. *National Data Laboratory, Beltsville, MD*

New Decision Tool Targets Rangeland Erosion to Save Money and Conserve Soil

Soil erosion from agricultural lands and deposits of sediment into rivers and lakes are persistent environmental challenges that cost the United States over $6 billion every year. In collaboration with ARS scientists in Boise, Idaho, and Tucson, Arizona, the scientists at the Great Basin Rangelands Research Unit in Reno, Nevada developed a new soil prediction tool for rangelands that helps land managers predict long-term soil loss after individual storms. This new tool provides a way for land managers to predict where erosion will occur, and provides a way to assess the possible effectiveness of different conservation practices before soil degradation occurs. The tool has been adopted by the Natural Resources Conservation Service and is being used to evaluate existing conservation programs and how they can be enhanced to improve delivery of conservation in a more cost-effective manner by targeting areas of concern. This research contributes to the USDA Conservation Effects Assessment Project for western rangelands. *Great Basin Rangelands Research Unit, Reno, NV*

New Gene Inserted in Alfalfa Could Save Dairy Producers $100 Million Annually

More efficient food production will be required to meet increasing demands by a growing population. Reducing protein nitrogen losses in dairy operations is one strategy to improve production efficiency. ARS researchers identified a novel red clover enzyme and transferred the gene that encodes this enzyme to alfalfa. If red clover phaselic acid protection can be reconstituted in alfalfa, it is estimated that improved protein and nitrogen utilization would save farmers more than $100 million annually by reducing the need for purchased

supplemental feed proteins. Improved efficiency could also substantially reduce nitrogen waste from cattle on dairies which would end up in surface and ground waters. Plants with higher levels of phaselic acid may also be more resistant to ultraviolet light and ozone pollution stresses, as well as stresses from insect pests and plant pathogens. *U.S. Dairy Forage Research Center, Madison, WI*

Red River Runner Peanut Variety Released

RED RIVER RUNNER (RRR) is the latest high value peanut variety released by the USDA-ARS peanut breeding program at the Plant Science Research Unit in Stillwater, Oklahoma. Cooperators on this variety release include Texas AgriLife Research and Oklahoma State University. RRR offers producers in the Southwestern U.S. three qualities necessary in a peanut variety for sustainable production: high-oleic fatty acid oil content; high yield; and superior grade. Beyond those important traits, RRR also offers moderate resistance to Sclerotinia blight, a fungal disease of peanut which can result in devastating yield and profit loss for producers. The superior grade potential of RRR is certainly the trait that makes peanut producers desire its production. In trials conducted in Oklahoma and Texas, RRR, when compared to all other runner varieties grown in the Southwestern U.S., averaged a significantly higher return by $80/acre or more. RRR is quickly becoming the most highly coveted runner peanut variety grown in the Southwestern U.S. with production limited only by seed availability. *Wheat, Peanut and Other Field Crops Research, Stillwater, OK*

A Salmon Line for Faster Growth and Greater Weight

Increasing harvest size and reducing the time to harvest Atlantic salmon are two goals of the salmon producers in North America. Commercial salmon producers in the United States utilize stocks that are not many generations removed from wild, unselected stocks and are legally required to culture stocks certified to be of North American origin. ARS researchers evaluated the growth of salmon from their breeding program in commercial sea cages in collaboration with industry. A salmon line selected for faster growth and greater weight was produced and germplasm was released to commercial producers. Utilization of improved germplasm will reduce the time to harvest, increase the profitability and sustainability of coldwater marine aquaculture in the United States, and provide a quality seafood product to U.S. consumers. *National Cold Water Marine Aquaculture Center, Franklin, ME*

Department of Commerce (DOC)

Technology transfer plays an important role in DOC's mission to promote job creation, economic growth, sustainable development, and improved standards of living for all Americans. DOC works in partnership with businesses; universities; state, tribal, and local governments; and communities to promote innovation and improve the Nation's overall competitiveness in the global economy. DOC pursues these objectives through policies and programs directed at strengthening the Nation's economic infrastructure, facilitating the development of cutting-edge science and technology, providing critical scientific information and data, and managing national resources.

DOC conducts R&D in numerous areas of fundamental and advanced science and technology at the National Institute of Standards and Technology (NIST), the laboratory facilities of the National Oceanic and Atmospheric Administration (NOAA), and the National Telecommunications and Information Administration's (NTIA's) Institute for Telecommunication Sciences (ITS). Technology transfer is a key part of the programmatic activities in each of these agencies' Federal laboratories. Technology transfer is about connecting the technological advances from DOC's science and engineering programs to the American economy.

In addition to the technology transfer efforts of DOC's own laboratories, DOC is responsible for coordinating technology transfer activities across Federal agencies. Through NIST, DOC coordinates the IAWGTT, which facilitates interagency discussion on policy, new approaches to technology transfer, and lessons learned from agency technology transfer programs. NIST also serves as the host agency for the Federal Laboratory Consortium for Technology Transfer (FLC), the nationwide network of Federal laboratories that provides a forum to develop strategies and opportunities for linking laboratory mission technologies and expertise with the marketplace.

More information about DOC's technology transfer activities is available on the following websites:

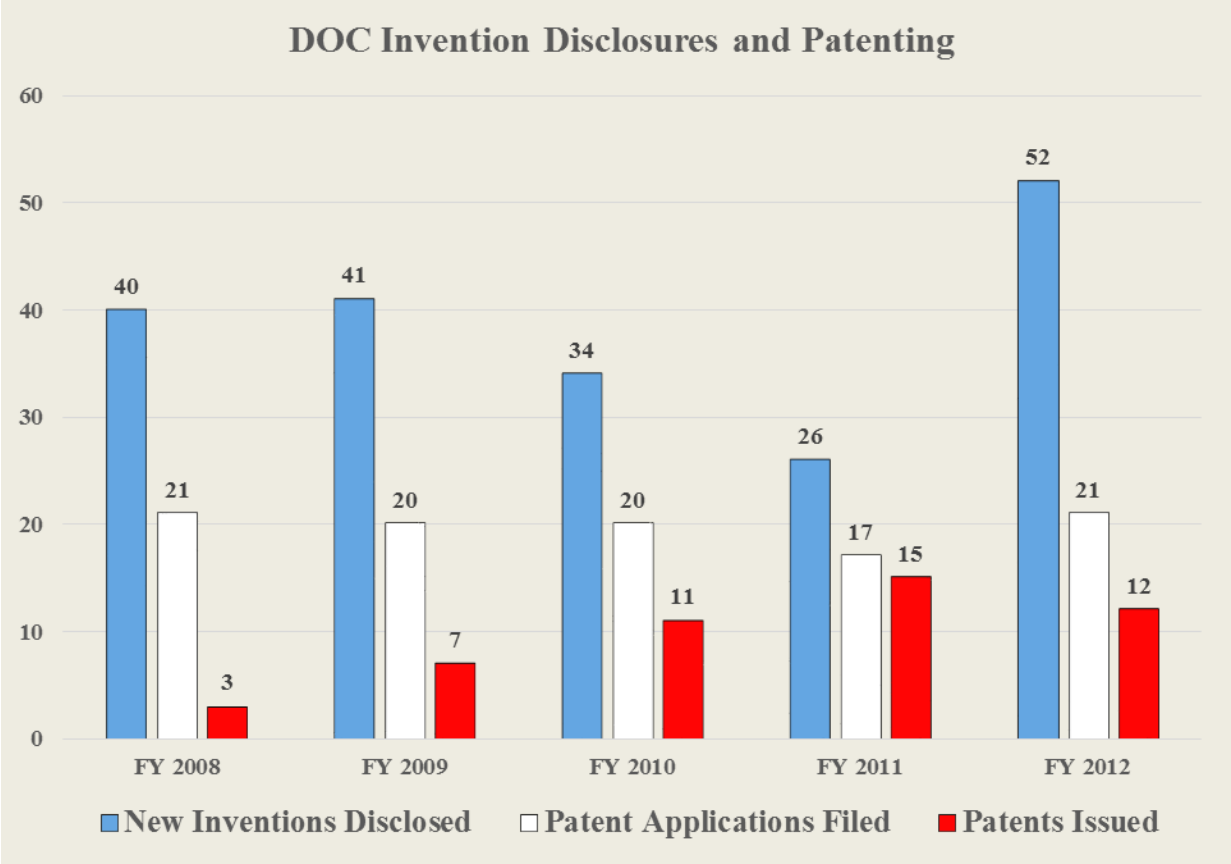
NIST: http://www.nist.gov/tpo/index.cfm

NOAA: http://www.noaa.gov/

ITS: http://www.its.bldrdoc.gov/programs/tech_transfer/

DOC Invention Disclosures and Patenting

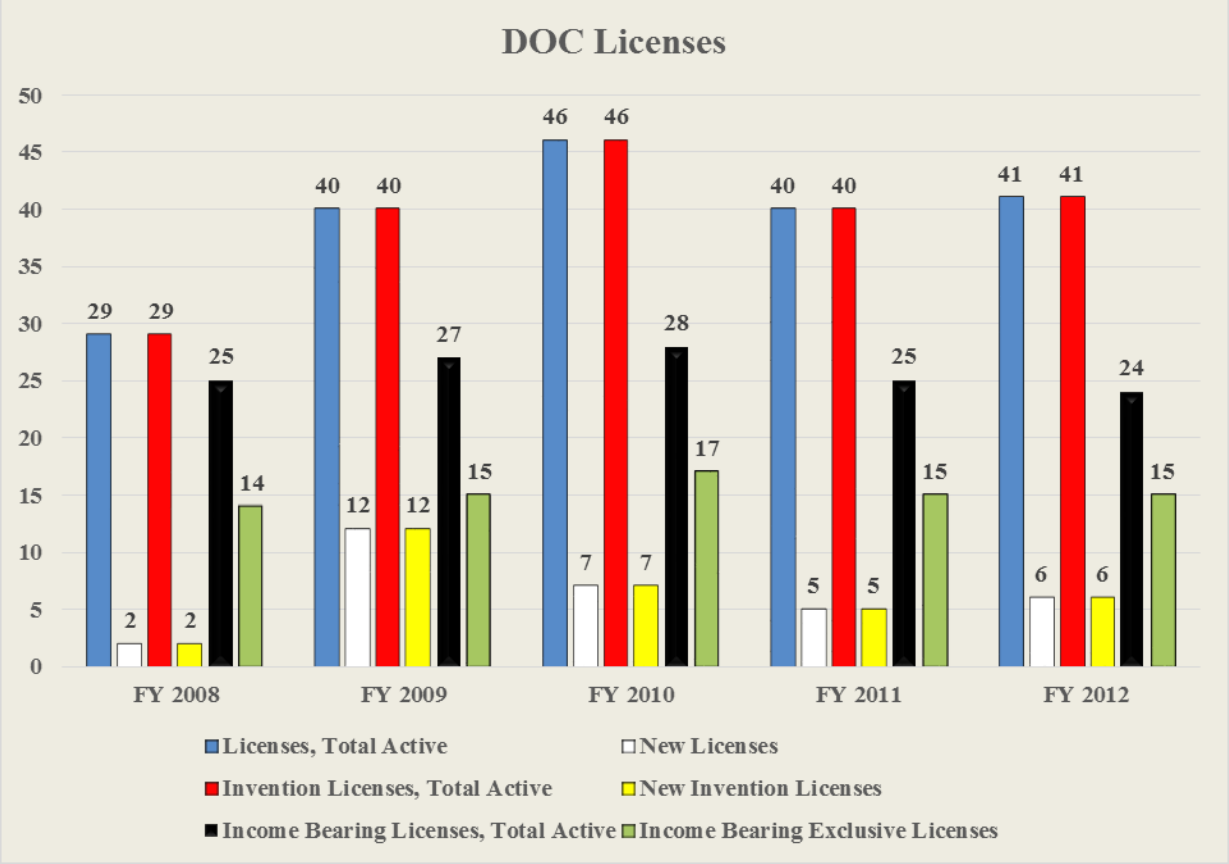
Between FY 2008 and FY 2012, the number of invention disclosures increased by 30% to a total of 52 in FY 2012. The number of patent applications filed stayed the same at 21. The number of patents issued increased by 300% from 3 in FY 2008 to 12 in FY 2012.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
New Inventions Disclosed	40	41	34	26	52
Patent Applications Filed	21	20	20	17	21
Patents Issued	3	7	11	15	12

DOC Licenses

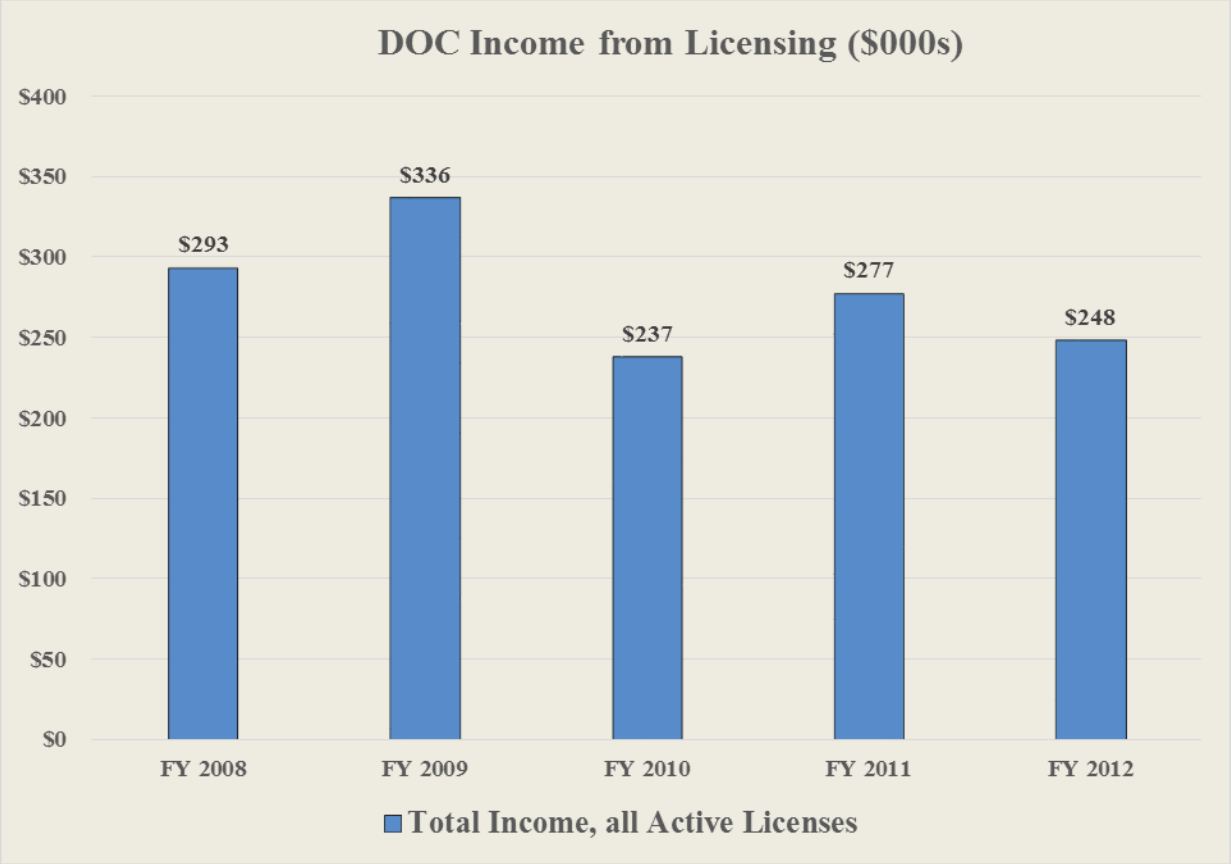
Between FY 2008 and FY 2012, the number of total active licenses (all of which are invention licenses) increased by 41% to a total of 41 in FY 2012. The number of income-bearing licenses declined by 4% to a total of 24, while the number of exclusive licenses increased by 7% to a total of 15 in FY 2012.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Licenses, Total Active	29	40	46	40	41
New Licenses	2	12	7	5	6
Invention Licenses, Total Active	29	40	46	40	41
New Invention Licenses	2	12	7	5	6
Income Bearing Licenses, Total Active	25	27	28	25	24
Income Bearing Exclusive Licenses	14	15	17	15	15

DOC Income from Licensing

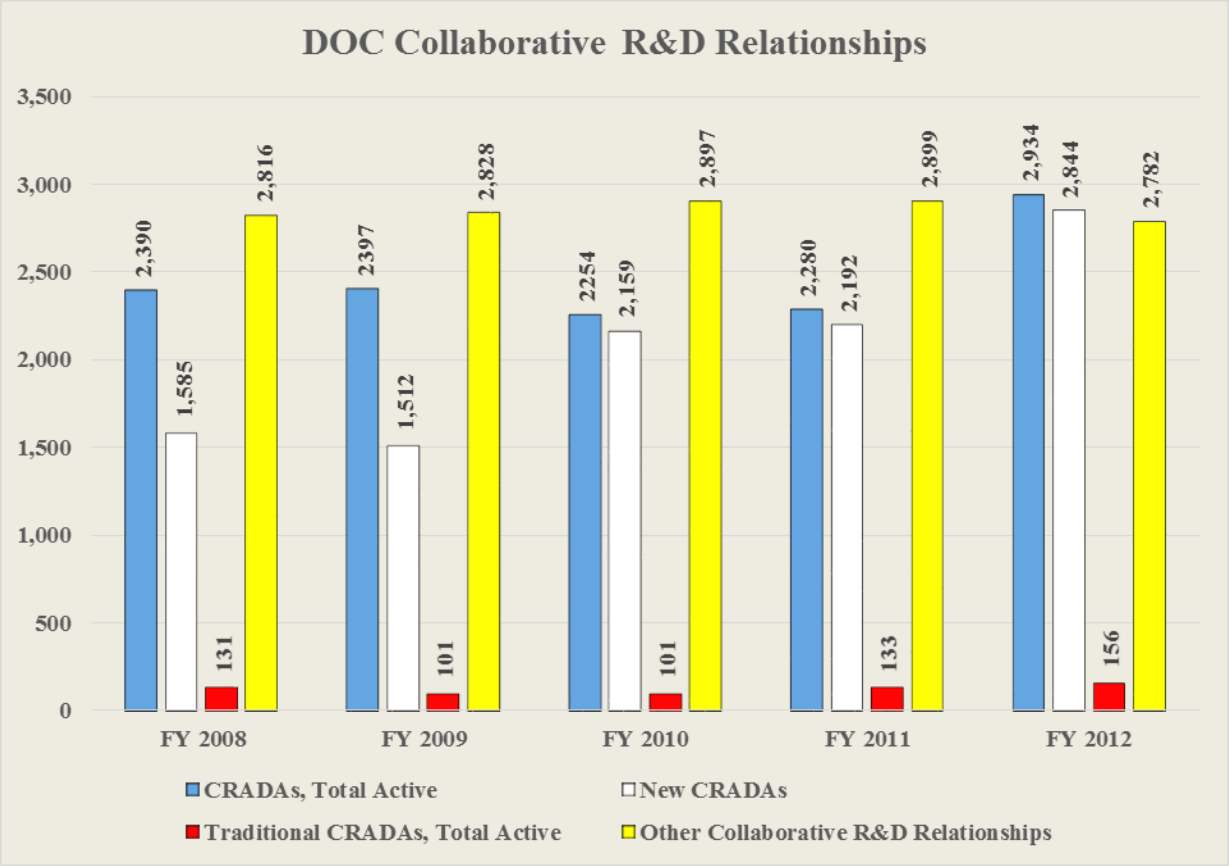
Between FY 2008 and FY 2012, income from all licensing decreased by 15% to a total of $248 thousand.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Total Income, all Active Licenses	$293	$336	$237	$277	$248
Invention Licenses	$293	$336	$237	$277	$248

DOC Collaborative R&D Relationships

Between FY 2008 and FY 2012, the number of active CRADAs increased by 23% to a total of 2,934. During this period, the number of traditional CRADAs declined by 19% to a total of 156, while other collaborative R&D relationships decreased by 1% to a total of 2,782.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
CRADAs, Total Active	2,390	2397	2254	2,280	2,934
New CRADAs	1,585	1,512	2,159	2,192	2,844
Traditional CRADAs, Total Active	131	101	101	133	156
Other Collaborative R&D Relationships	2,816	2,828	2,897	2,899	2,782

Downstream Success Stories for DOC

700 MHz Public Safety Broadband Demonstration Network CRADA Consortia

Public safety agencies have long struggled with effective cross-agency radio communications due mainly to incompatible systems and non-contiguous spectrum assignments. But newly enacted Congressional legislation will soon make broadband spectrum in the 700 MHz band available to public safety, allowing for a unified system that would foster nationwide roaming and interoperability.

In support of this effort, NIST, through its Public Safety Communications Research Program (PSCR) and in collaboration with NTIA and the Department of Homeland Security's (DHS's) Office for Interoperability and Compatibility (OIC), has built a 700 MHz Public Safety Broadband Demonstration Network, which provides manufacturers and first responders a location for early deployment of their systems in a multi-vendor, neutral host environment. Emergency responders can see how these broadband systems will function and determine through hands-on experience whether these systems meet their unique needs. This new public safety broadband communications network will allow for a unified system to foster nationwide roaming and interoperability.

Release of Two New Standards for Monitoring Human Exposure to Environmental Toxins

NIST, in collaboration with the Centers for Disease Control and Prevention (CDC), has developed two new Standard Reference Materials (SRMs) for measurements of human exposure to environmental toxins. Used as a sort of chemical ruler to check the accuracy of tests and analytic procedures, the new reference materials (SRMs 2668 and 3668) replace and improve older versions, adding measures for emerging environmental contaminants such as perchlorate, a chemical that the Environmental Protection Agency has targeted for regulation as a contaminant under the Safe Drinking Water Act. Because sample collection is non-invasive and the test results reflect exposures as recent as two days, urine is preferred for clinical diagnostics and monitoring of toxic environmental chemicals. Once collected, samples are frozen while they wait testing.

In order to generate comparable results among tests, best practices in clinical chemistry require that a reference material should closely mimic how a specimen would respond to these tests. The best way to achieve such close resemblance is to make the physical, chemical and biological properties of the reference material match those of the specimen as closely as possible to the specimen.

In addition to NIST, the CDC, Mayo Clinic and the New York State Department of Health made certification measurements of the two SRMs to ensure their relevance for the intended applications. The development of SRMs 2668 and 3668 reflects NIST's commitment to continually improve chemical metrology to improve the health of the Nation.

NIST Standard Available for Better Diagnosis, Treatment of Cytomegalovirus

A new clinical SRM from NIST will help health care professionals more accurately diagnose and treat cytomegalovirus (CMV), a common pathogen that is particularly dangerous for infants and persons with weakened immune systems.

CMV is found in 50 to 80 percent of the population. It is a member of the herpes family of viruses that includes two herpes simplex viruses (the causes of cold sores and genital herpes), the varicella-zoster virus (the cause of chicken pox and shingles), and the Epstein-Barr virus (the cause of mononucleosis). Like its cousin herpes viruses, CMV generally remains latent in an infected person unless certain conditions trigger

its activation. CMV poses a significant health risk to people who are immunocompromised (such as organ transplant patients or cancer patients undergoing chemotherapy) and to babies who receive the virus from their mothers before birth. Congenital CMV infections cause more long-term problems and childhood deaths than many other prenatal disorders including fetal alcohol syndrome, Down syndrome and neural tube defects such as spinal bifida.

If a CMV infection becomes dangerous, antiviral agents can be used to moderate the impact. Unfortunately, many of these compounds are toxic, so a physician must know the severity of the infection—a measure known as viral load (number of virus copies per microliter of blood)—to prescribe the optimal dosage and duration of treatment. The current means of measuring viral load is to use polymerase chain reaction (PCR)—the standard technique for "amplifying" or making multiple copies of a DNA segment or molecule—to amplify a region of the CMV gene and then use a calibration curve to estimate the number of virus particles in the original sample. Accuracy of these measurements can vary greatly from one test facility to another as there are many different PCR protocols used to determine viral load, including commercial and "in-house" (privately developed) laboratory assays.

The new NIST reference, SRM 2366, addresses the variability problem by providing a standardized CMV DNA. Consistency of the viral DNA in the standard was ensured by manufacturing it in *Escherichia coli* bacteria. Each of these recombinant *E. coli* cells contains a copy of the CMV genome in a "DNA construct"—an artificially constructed segment of nucleic acid that codes for a specific product, in this case, CMV DNA. The DNA copies made by this *E. coli* cell culture "factory" can then be purified and quantified using digital PCR. SRM 2366 consists of three solutions, each with a specific concentration of CMV DNA copies per microliter: 420; 1,702; and 19,641. These are designed to qualify prepared calibration samples (known as calibrants). They also can be used as quality control samples for diagnostic equipment. For added traceability, the SRM certificate of analysis includes the genetic sequences of the nine CMV genome regions copied for the standard. SRM 2366 joins more than 50 reference materials produced by NIST for quality control in clinical testing.

NOAA: Hail and Severe Storm Risk Management Initiative (NSSL)

Atmospheric and Environmental Research (AER) and the National Severe Storm Laboratory (NSSL) are collaborating to fuel the research and development of operational weather risk management solutions for insurance and other industries impacted by severe storms. AER also announced the AER Respond™ hail analysis service, which leveraged NSSL data to enable insurance carriers to reduce loss adjustment expense and cycle times by integrating property-specific analytics into the hail claims workflow.

The alliance combines NSSL's resources in weather radar data processing with AER's expertise in providing data-driven solutions that improve industry practice. As part of a Cooperative Research and Development Agreement (CRADA), NSSL provided AER access to high-resolution radar data across the continental United States so AER could develop value-added products and test the products in the insurance industry. AER in turn provided insurance industry feedback and quality control assessments to NSSL for inclusion back into their radar algorithms.

Storm-related damage is a growing problem for insurance carriers and their customers. AER adds value through targeted scientific analysis and by building applications for business to pinpoint the location and

severity of weather events like straight-line winds, hail, rain, and tornadoes. The expanded real-time hail and rain capabilities complement AER's existing services related to hurricanes, wildfires, and other natural hazards.

"NSSL is world renowned for their knowledge and leadership in storm observation and prediction," said Paul Walsh, AER senior vice president. "Pairing this data with the insurance expertise and analytic capabilities within our enterprise enables AER to provide a game-changing weather risk management capability for the insurance industry. An example is AER Respond which catastrophe teams can use to reduce expense and claims cycle times, determine resource demand and logistics, and validate the date of loss of each weather-related claim."

NOAA: ESRL/GSD Software Used by U. Wisconsin and NESDIS to help develop Next-Generation Geostationary Operational Environmental Satellite (GOES) Products (ESRL GSD)

Global Positioning System water vapor estimates (GPS Met) are recognized around the world as an accurate and reliable way of monitoring total column precipitable water vapor under all weather conditions. Since 2005, GPS Met data and products produced by the Forecast Applications Branch of the ESRL's Global Systems Division have been used by NOAA's National Weather Service in its operational numerical weather prediction models; Regional Forecasters and the Storm Prediction Center in their short-range weather warnings and forecasts; the Upper-Air Program to monitor the performance of rawinsondes and assess the quality of rawinsonde improvements; and the Office of Science and Technology to evaluate moisture soundings made by commercial aircraft during ascent from and descent into U.S. airports across the country.

Most recently, software designed and developed by ESRL/GSD has been used by NESDIS and the NOAA Cooperative Institute for Meteorological Satellite Studies (CIMSS) at the University of Wisconsin-Madison's Space Science and Engineering Center to assess next-generation data processing algorithms for operational and future U.S. (GOES-R) geostationary orbit environmental satellites. ESRL software compares Total Precipitable Water Vapor products produced from data acquired by operational and research satellites, as well as simulated data and products derived from these observations, with actual GPS Met observations made over CONUS in near real-time. This capability provides mission scientists, instrument designers and software developers with the ability to immediately assess the impact of changes in their codes and system software for the first time, and allows them to evaluate the relative merits of different data processing schemes over long periods of time with high reliability.

NOAA: Hurricane Forecast Improvement Program (HFIP)

HFIP provides the basis for NOAA and other agencies to coordinate hurricane research needed to significantly improve guidance for hurricane track, intensity, and storm surge forecasts. It also engages and aligns the inter-agency and larger scientific community efforts towards addressing the challenges posed to improve hurricane forecasts. The goals of the HFIP are to improve the accuracy and reliability of hurricane forecasts; to extend lead time for hurricane forecasts with increased certainty; and to increase confidence in hurricane forecasts. These efforts will require major investments in enhanced observational strategies, improved data assimilation, numerical model systems, and expanded forecast applications based on the high resolution and ensemble-based numerical prediction systems.

The specific goals of the HFIP are to reduce the average errors of hurricane track and intensity forecasts by 20% within five years and 50% in ten years with a forecast period out to 7 days. The benefits of HFIP will significantly improve NOAA's forecast services through improved hurricane forecast science and technology. Forecasts of higher accuracy and greater reliability (i.e., user confidence) are expected to lead to improved public response, including savings of life and property. Experimental forecast guidance from various HFIP contributors is provided in a consolidated web-based information portal at http://www.hfip.org/products/.

ITS: Table Mountain Research

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

- For the past six years, the University of Colorado's Research and Engineering Center for Unmanned Vehicles has conducted measurements on the performance of ad hoc wireless networks with both ground-based and airborne terminals at Table Mountain.
- In FY 2012, several companies performed antenna, Light Detection and Ranging (LIDAR)/Global Positioning Satellite (GPS), and other testing at the Table Mountain turntable facility under a CRADA.
- Lockheed Martin Coherent Technologies is in its thirteenth year of field-testing and characterizing components, subsystems and systems for eye-safe coherent laser radar. This has benefited NTIA and the Department of Defense.

Department of Defense (DoD)

The purpose of the DoD Office of Technology Transition is to ensure, to the maximum extent practicable, technology developed for national security purposes is integrated into the private sector of the United States in order to enhance national technology and industrial base, reinvestment and conversion activities.

DoD is unique in applying the principles, practices, and tools of technology transfer in the execution of its mission. DOD funds and develops mission-focused technology, and technology transfer statutory authorities enable it to promote and facilitate the commercialization of that technology for both military and civilian purposes. Concurrently, DoD is a technology buyer as it strives to purchase new technology embodied in products and systems to meet the challenges faced by our warfighters. In many instances, technology transfer and technology transition are becoming a seamless path to fielding new technology critical to responding to the new and dynamic threats of asymmetric warfare, the global war on terrorism, and the ever-expanding role of civil assistance and disaster recovery worldwide. In the 1980s, when much of the technology transfer legislation was enacted, the Federal government, including DoD, was the principle funding source for R&D. Consequently, technology transfer was viewed as a "spin out" to the marketplace, a stimulus to the domestic economy, and a return on investment for taxpayer funded R&D. Today, the majority of U.S. R&D is industry-funded. This shift in funding has led to a greater emphasis on technology transfer as a collaborative effort between DoD labs and their partners in industry, academia, and state and local government.

Each of the Military Services, Defense Agencies, and Office of the Secretary of Defense

(OSD) maintain technology transfer websites to inform the public and make available general information. The websites are:

http://www.acq.osd.mil/ott/techtransit

http://www.arl.army.mil/main/Main/default.cfm?Action=6

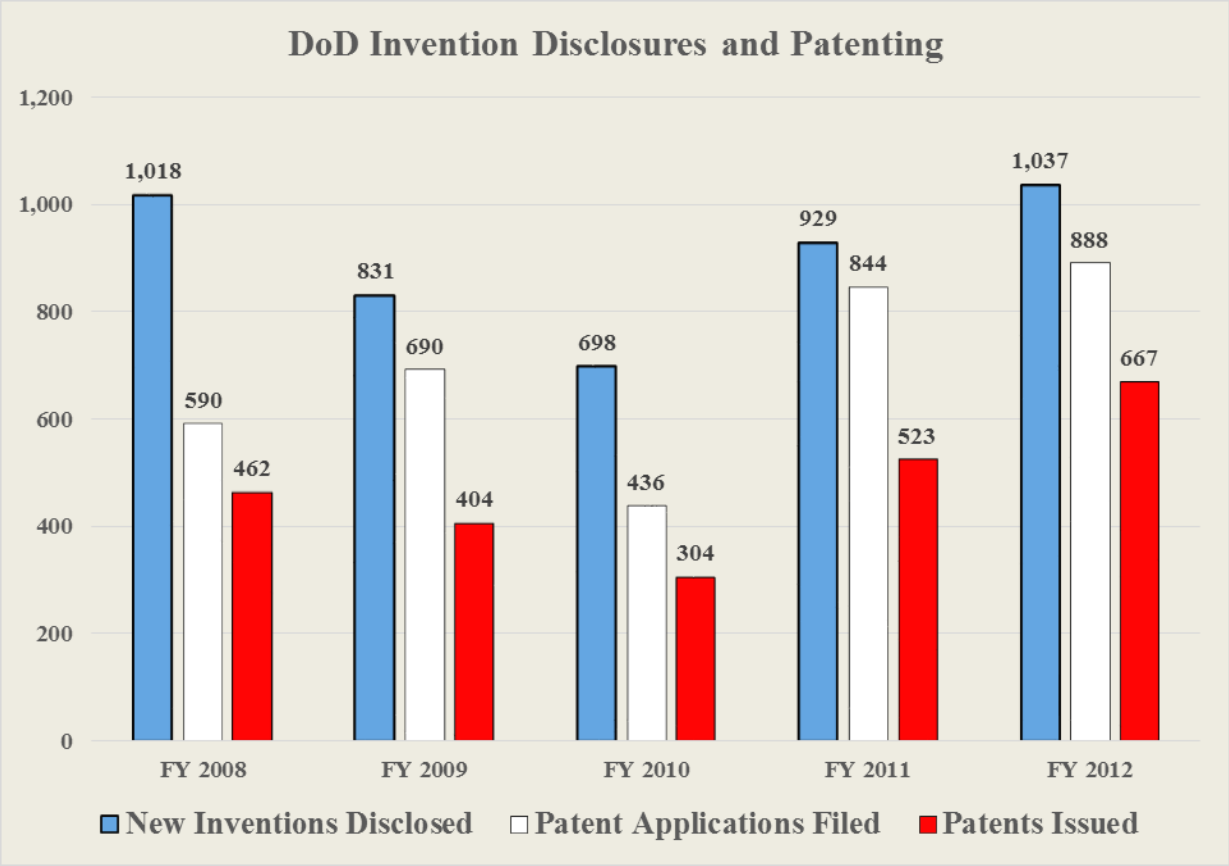
http://www.onr.navy.mil/en/Science-Technology/Directorates/Transition/Technology-Transfer-T2.aspx
http://www.wpafb.af.mil/library/factsheets/factsheet.asp?id=6026

http://www.mda.mil/business/tech_apps.html

http://www.jfcom.mil/about/industry.htm.

DoD Invention Disclosures and Patenting

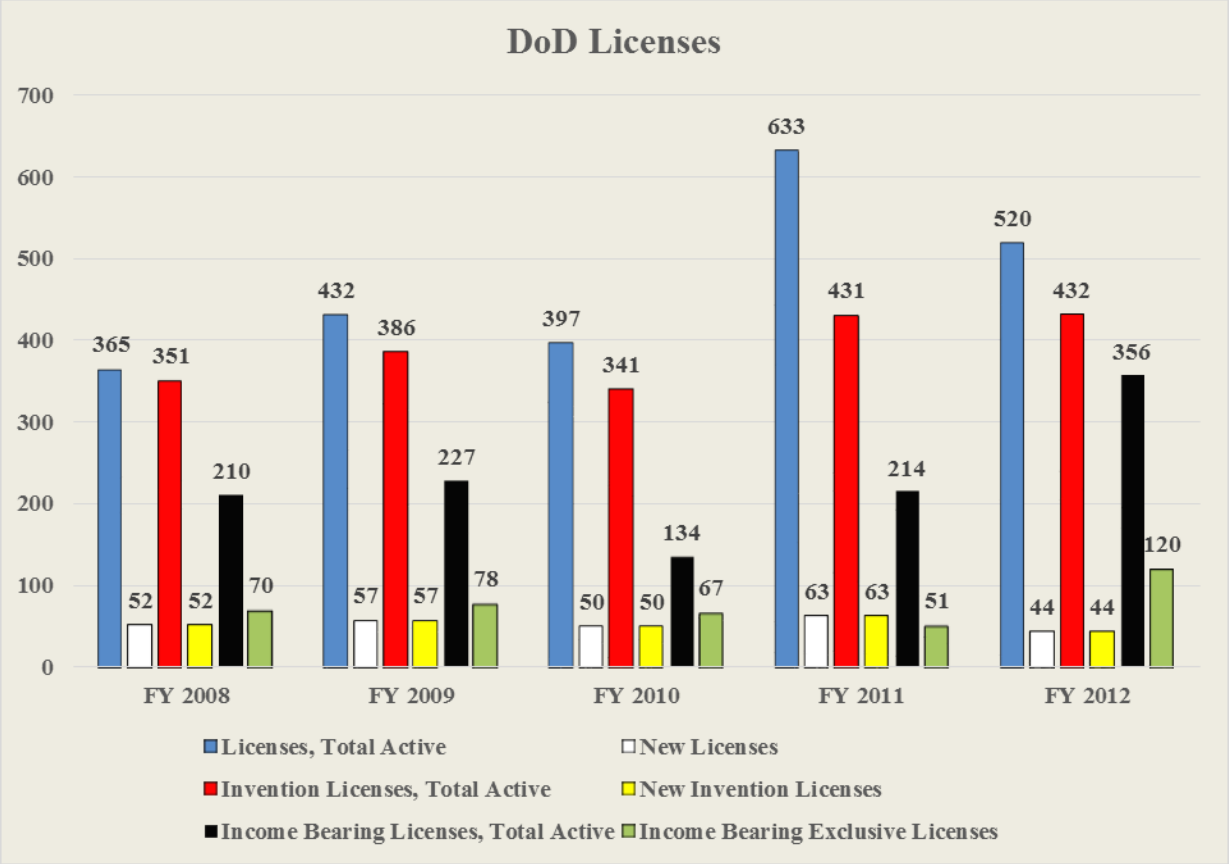
Between FY 2008 and FY 2012, the number of invention disclosures increased by 2% to a total of 1,037 in FY 2012. The number of patent applications filed increased by 51% to a total of 888. The number of patents issued increased by 44% to a total of 667 in FY 2012.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
New Inventions Disclosed	1,018	831	698	929	1,037
Patent Applications Filed	590	690	436	844	888
Patents Issued	462	404	304	523	667

DoD Licenses

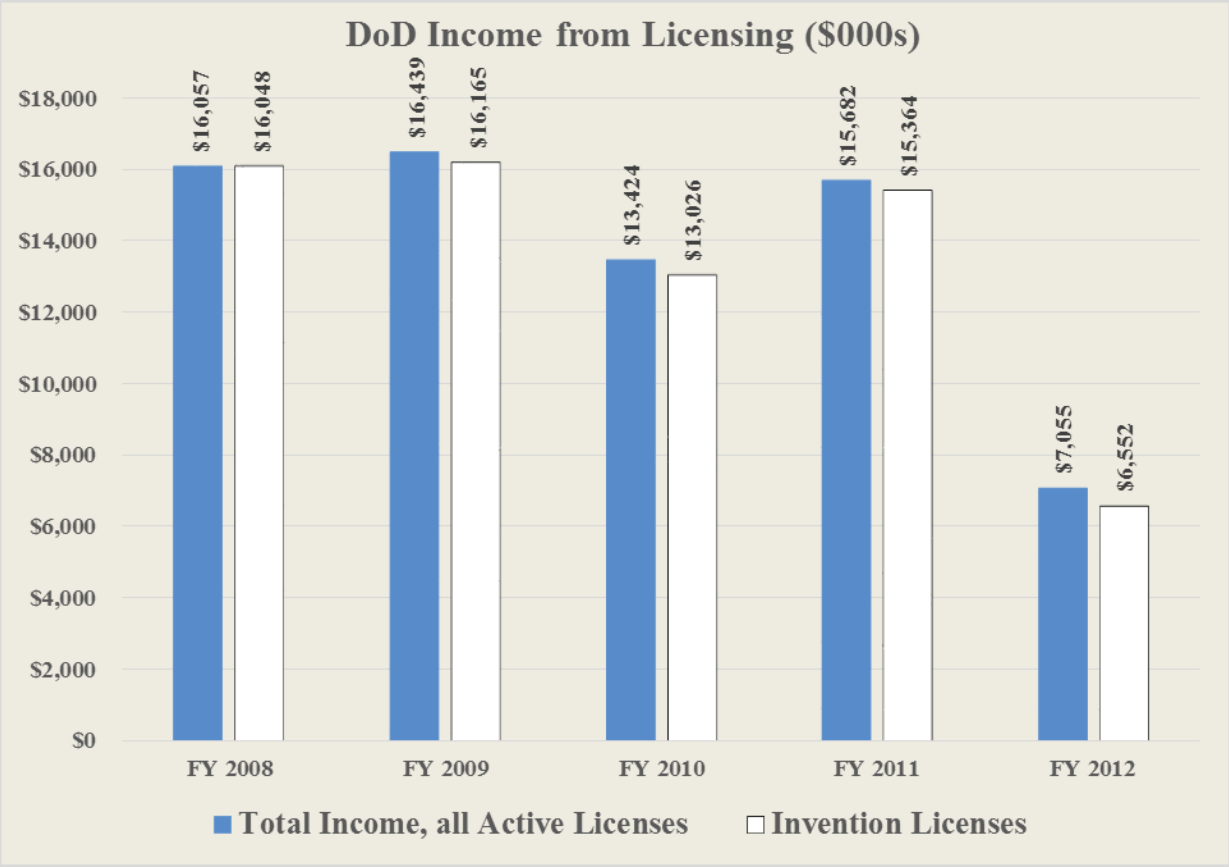
Between FY 2008 and FY 2012, the number of total active licenses increased by 42% to a total of 520 in FY 2012, while the number of invention licenses increased by 23% to 432. The number of income-bearing licenses increased by 70% to 356 and the number of income-bearing, exclusive licenses increased by 71% to a total of 120.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Licenses, Total Active	365	432	397	633	520
New Licenses	52	57	50	63	44
Invention Licenses, Total Active	351	386	341	431	432
New Invention Licenses	52	57	50	63	44
Income Bearing Licenses, Total Active	210	227	134	214	356
Income Bearing Exclusive Licenses	70	78	67	51	120

DoD Income from Licensing

Between FY 2008 and FY 2012, income from all licensing decreased by 56% to a total of $7.06 million. Income from invention licenses also declined over this period by 59% to a total of $6.55 million.[13]

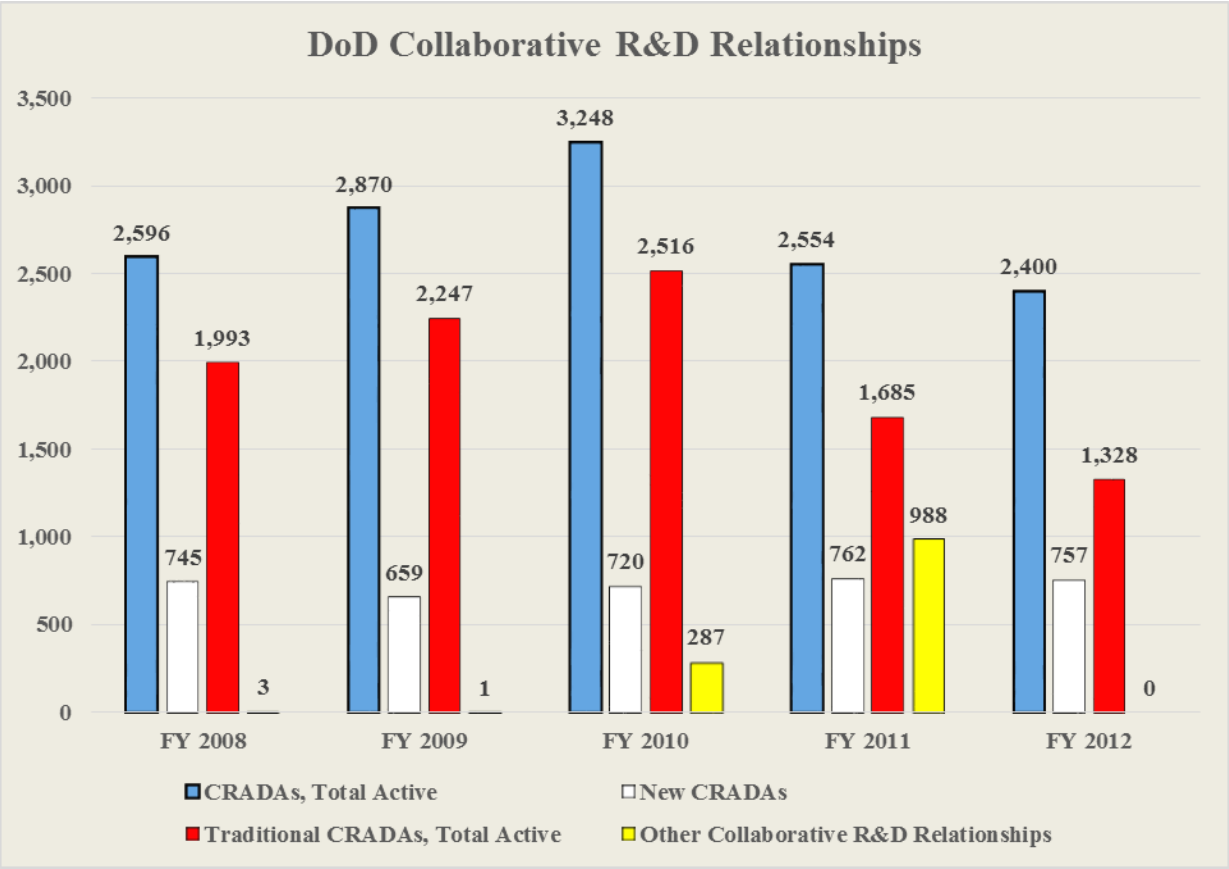


	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Total Income, all Active Licenses	$16,057	$16,439	$13,424	$15,682	$7,055
Invention Licenses	$16,048	$16,165	$13,026	$15,364	$6,552

[13] In FY2012, no royalty income was received from a USU license due to ongoing litigation. This case has been settled and USU revenue of $7.8 million which would otherwise have been received in FY 2012 will be reported in FY 2013.

DoD Collaborative R&D Relationships

Between FY 2008 and FY 2012, the number of active CRADAs decreased by 8% to a total of 2,400. The number of traditional CRADAs declined by 33% to 1,328, while the number of other collaborative R&D relationships which increased from 3 in FY 2008 to 988 in FY 2011, and were reported to be zero in FY 2012.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
CRADAs, Total Active	2,596	2,870	3,248	2,554	2,400
New CRADAs	745	659	720	762	757
Traditional CRADAs, Total Active	1,993	2,247	2,516	1,685	1,328
Other Collaborative R&D Relationships	3	1	287	988	0

Department of Energy (DOE)

The Department of Energy's 17 National Laboratories conduct world-class research in pursuit of technologies that will contribute to energy independence, enhance our national security, protect our environment, and increase our economic prosperity.

DOE's national scientific user facilities provide researchers with some of the most advanced, if not world-class, tools of modern science including accelerators, colliders, supercomputers, light sources, and neutron sources, as well as facilities for studying the nanoworld, the environment, and the atmosphere. In Fiscal Year 2012 over 29,000 researchers from academia, industry, and government laboratories, spanning all fifty states and the District of Columbia, utilized these unique facilities to perform cutting-edge scientific research.

The Department continues to be guided by the technology transfer principles established in the *FY 2011 Secretarial Policy Statement on Technology Transfer at DOE Facilities*[14] including: commitment to improving technology transfer policies and procedures; empowerment of innovators; fairness of opportunity; facilitation of commercialization transactions; visibility to laboratory capabilities and intellectual property; leveraging resources; assuring and measuring impact; streamlined processes and transparency; and sharing of best practices.

Increasing stakeholder engagement was a top priority in 2012. Several initiatives were continued or established to support this priority including:

- The America's Next Top Energy Innovator[15] options program;
- The creation of the Technology Transfer Working Group[16], as required by the Energy Policy Act of 2005, section 1001;
- The creation of the DOE Licensing Guide and Sample License[17];
- An expansion of the Technology Transfer Portal, a one-stop resource for DOE Energy Efficiency and Renewable Energy (EERR) technologies[18]; and
- The Agreement for Commercializing Technology (ACT)[19] pilot.

More information about DOE's technology transfer activities is available at

http://technologytransfer.energy.gov/.

DOE Invention Disclosures and Patenting

Between FY 2008 and FY 2012, the number of invention disclosures increased by 14% to a total of 1,661 in FY 2012. The number of patent applications filed decreased by 14% to 780, and the number of patents issued increased by 31% to 483.

[14] http://www.energy.gov/sites/prod/files/gcprod/documents/Policy_Statement_on_TT.pdf

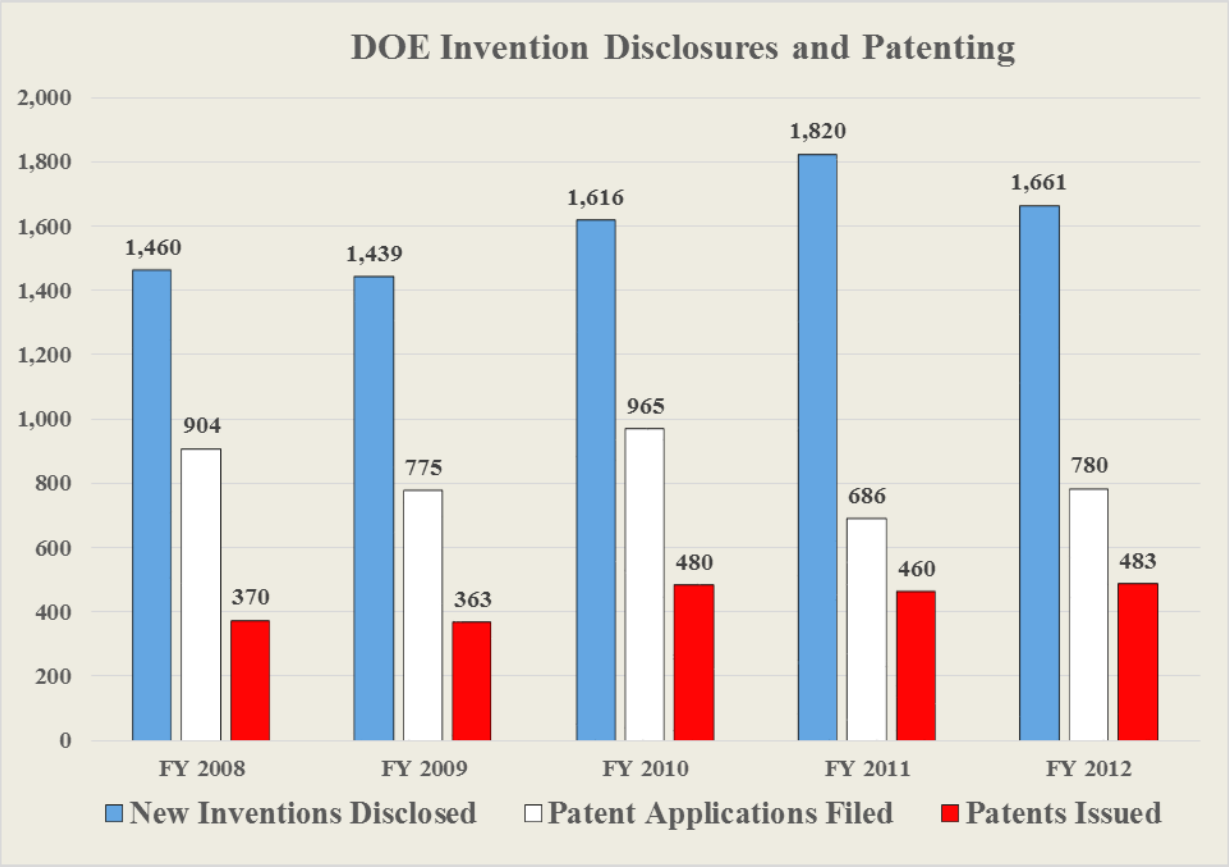
[15] http://energy.gov/science-innovation/innovation/americas-next-top-energy-innovator/americas-next-top-energy-innovator

[16] https://www.ameslab.gov/techtransfer/ttwg

[17] http://technologytransfer.energy.gov/LicensingGuideFINAL.pdf

[18] http://techportal.eere.energy.gov/

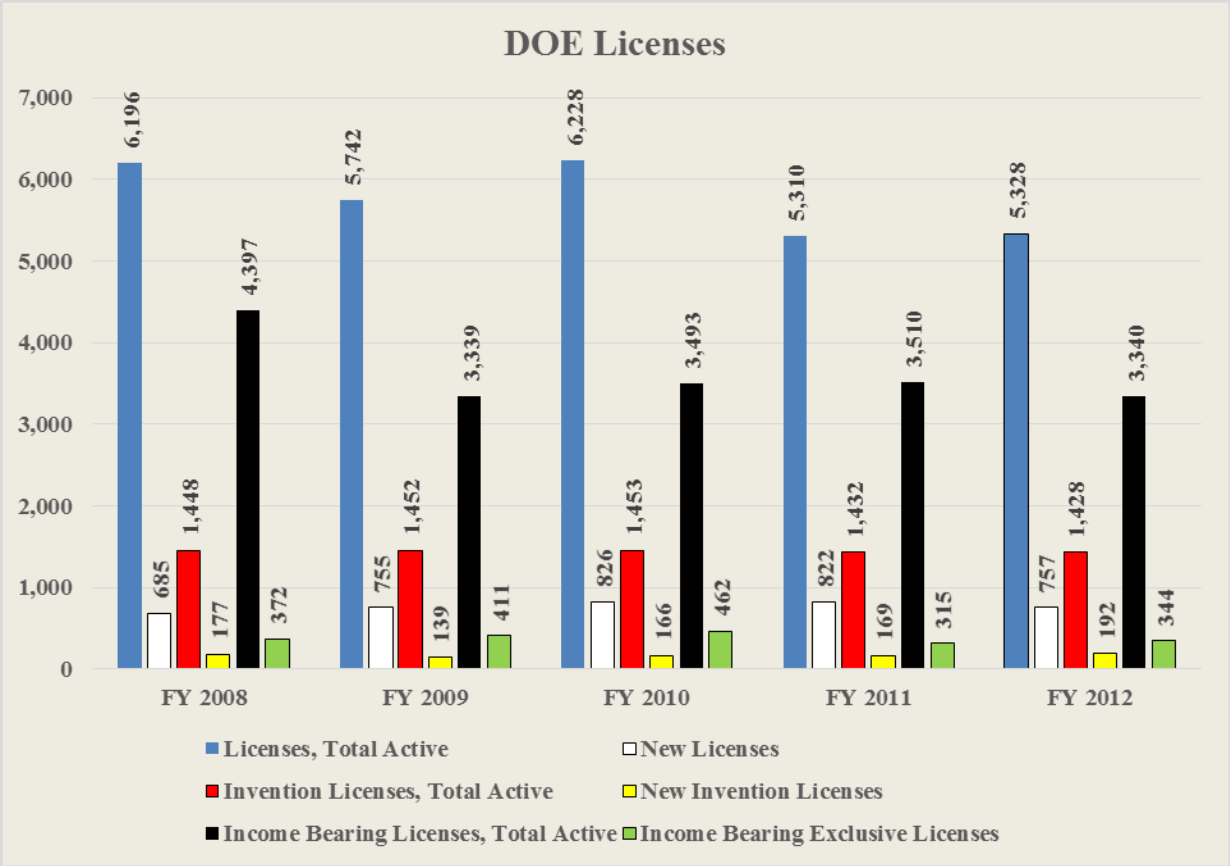
[19] http://www.federallabs.org/flc/education/t2-mechanisms/mech-profile/?mechanism_id=185



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
New Inventions Disclosed	1,460	1,439	1,616	1,820	1,661
Patent Applications Filed	904	775	965	686	780
Patents Issued	370	363	480	460	483

DOE Licenses

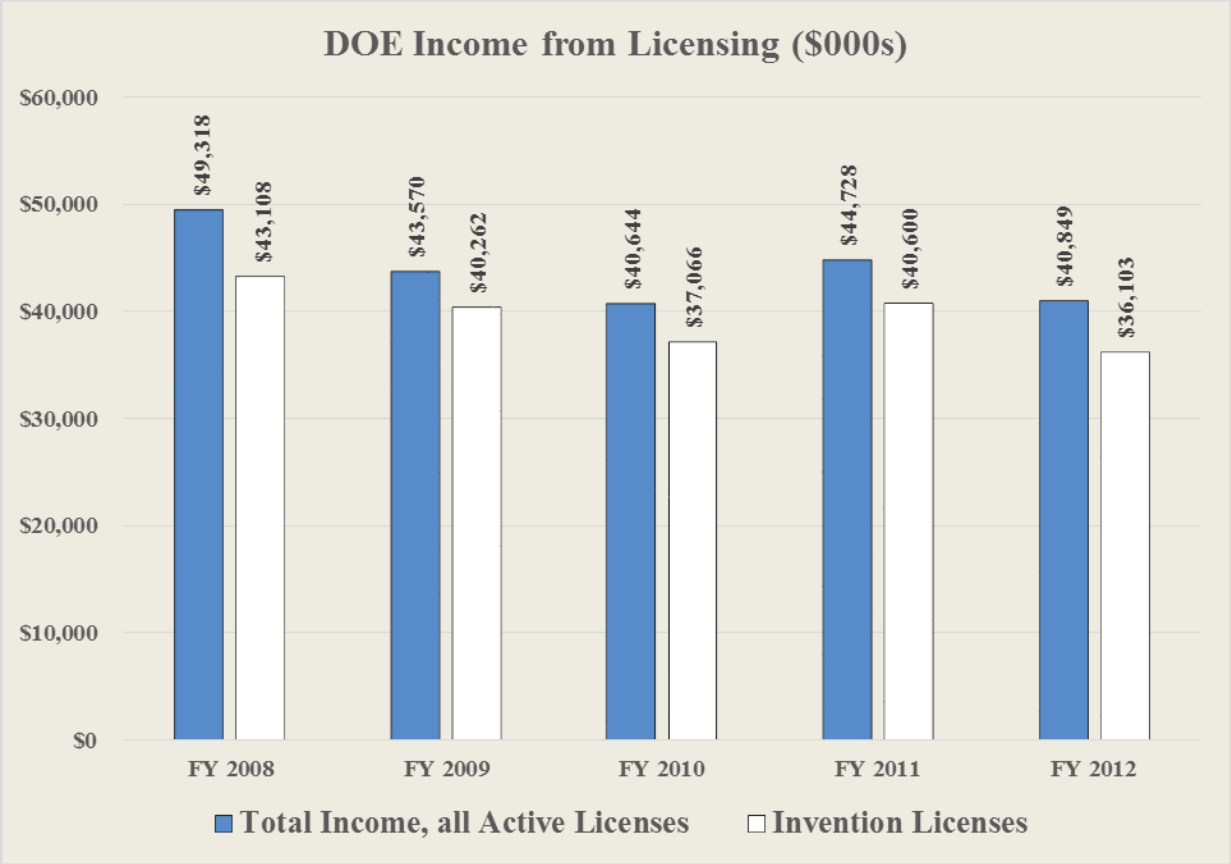
Between FY 2008 and FY 2012, the number of total active licenses decreased by 14% to a total of 5,328 in FY 2012, and the number of invention licenses declined by 1% to 1,428. The number of income-bearing licenses declined by 24% to 3,340, while the number of income-bearing, exclusive licenses decreased by 8% to a total of 344.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Licenses, Total Active	6,196	5,742	6,228	5,310	5,328
New Licenses	685	755	826	822	757
Invention Licenses, Total Active	1,448	1,452	1,453	1,432	1,428
New Invention Licenses	177	139	166	169	192
Income Bearing Licenses, Total Active	4,397	3,339	3,493	3,510	3,340
Income Bearing Exclusive Licenses	372	411	462	315	344

DOE Income from Licensing

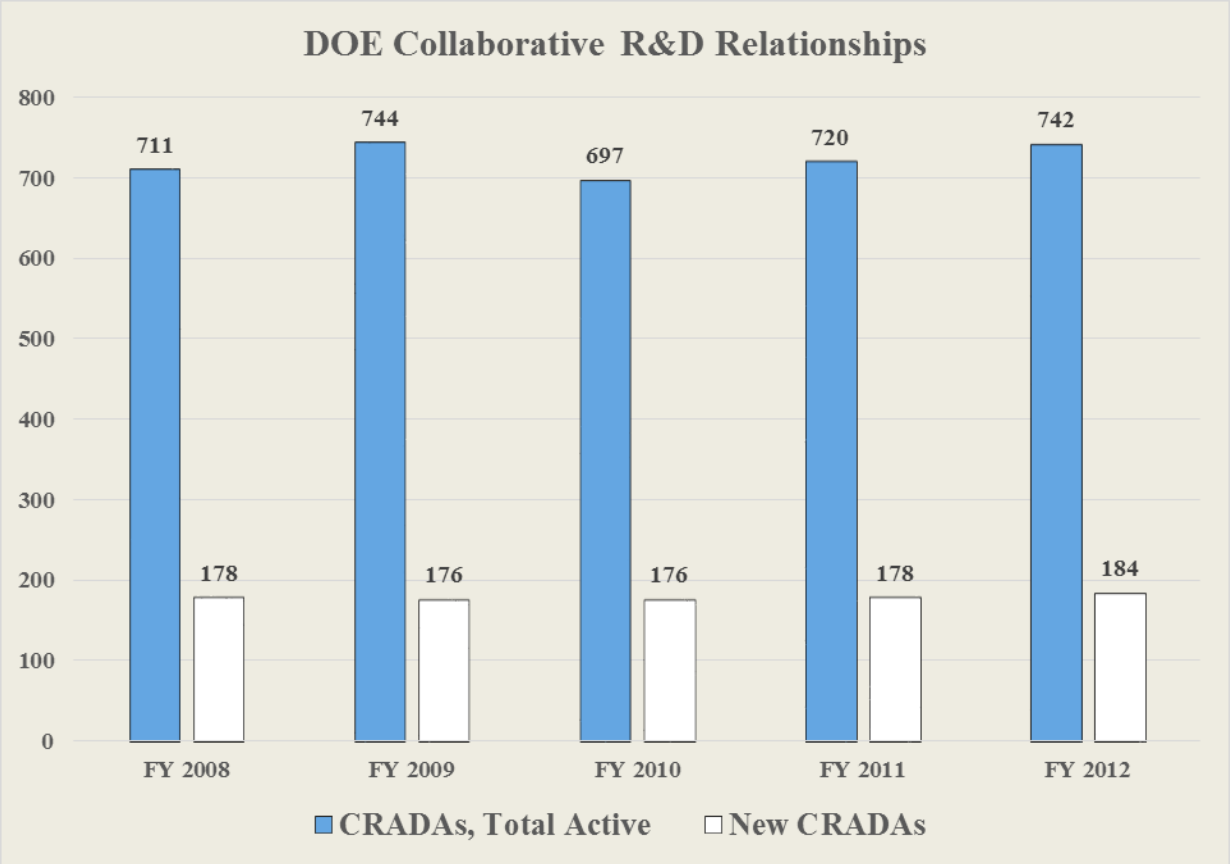
Between FY 2008 and FY 2012, income from all licensing decreased by 17% to a total of $40.85 million. Income from invention licenses also decreased by 16% to a total of $36.10 million.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Total Income, all Active Licenses	$49,318	$43,570	$40,644	$44,728	$40,849
Invention Licenses	$43,108	$40,262	$37,066	$40,600	$36,103

DOE Collaborative R&D Relationships

Between FY 2008 and FY 2012, the number of active CRADAs increased by 4% to a total of 742.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
CRADAs, Total Active	711	744	697	720	742
New CRADAs	178	176	176	178	184
Traditional CRADAs, Total Active	711	744	697	720	742
Other Collaborative R&D Relationships	0	0	0	0	0

Downstream Success Stories for DOE

Desiccant-based air-conditioning uses far less energy

In 2012, the National Renewable Energy Laboratory (NREL) won an R&D100 award for its Desiccant-enhanced Evaporative (DEVAP) Air-Conditioning Cycle technology. The technology was developed by NREL scientists along with industrial partners AIL Research and Synapse Product Development LLC. DEVAP cools commercial buildings at a small fraction of the energy use of a traditional cooler, provides superior comfort in any climate, releases far less carbon dioxide, and could cut costly peak electricity demand by 80 percent.

DEVAP can work in any climate, including areas that are hot and humid, by employing an innovative combination of air-cooling technologies to reduce energy use. It relies on the desiccants' capacity to create dry air using heat and evaporative coolers' capacity to take dry air and make cold air.

Air conditioning currently consumes about 15% of the electricity generated in the United States and is a major contributor to peak electrical demand on hot summer days, which can lead to escalating power costs, brownouts, and rolling blackouts. DEVAP uses 40 percent to 80 percent less energy than top-of-the-line refrigerant-based air conditioning.

MicroPower Source

A collaboration between Sandia National Laboratory (SNL), Pacific Northwest National Laboratory (PNNL), Front Edge Technology, and University of California at Los Angeles (UCLA), has resulted in the development of the Micro Power Source, a system that integrates a lithium-ion-based solid electrolyte battery with an ultra-thin PV cell, producing a self-charging battery.

The micro power source is an ultra-small form factor, energy harvesting (self-charging) power source that occupies a volume of only 1µL, yet possesses a high peak-power density greater than 1,000 W/L. Originally funded by Defense Advanced Research Projects Agency (DARPA), the device features Sandia's Microsystems and Engineering Sciences Applications fabricated ultra-thin PV cells; Front Edge Technology's thin film rechargeable lithium cells and masking technique for manufacturing thin film batteries; PNNL's ultra-thin sealing material; and UCLA Nanofabrication Lab's assembly and packaging techniques.

While DARPA's specific applications are not available, the micro power source has the potential to revolutionize a number of commercial industries such as those involving handheld electronics, cyber security, and alternative energy. Front Edge Technology, Inc., has plans to market this product in the future.

Sandia National Laboratories is managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration. Pacific Northwest National Laboratory is a multi-program laboratory managed and operated by Battelle for the U.S. Department of Energy's Office of Science.

Fifteen scientists, engineers to be inducted into LLNL Entrepreneurs Hall of Fame

In October 2012, 15 former Lawrence Livermore National Laboratory (LLNL) scientists and engineers were inducted into the Lab's new Entrepreneurs' Hall of Fame (EHF). The researchers who were inducted developed technologies during or after their Laboratory careers that created major economic impacts and spawned important new companies.

Once in the commercial world, the LLNL EHF inductees started 23 companies and developed about 50 products. Four of the companies -- Cepheid, Digital Globe, Valid Logic/Cadence Design and Rambus -- founded or co-founded by six of the inductees have a current valuation of more than $8 billion. In addition, four inductees were leaders in the computer industry and computer-aided design industry in Silicon Valley, collectively starting 13 companies there.

Among the products invented by other inductees are the Duracell battery tester, (spawned by Lab research in liquid crystal plastics), the imagery used for Google Earth, the software that first enabled computerized automobile crash simulation (which currently saves that industry about $14 billion a year in cost avoidance, according to a recent report by the Council on Competitiveness) and rapid polymerase chain reaction used for DNA analysis.

LLNL is managed and operated by Lawrence Livermore National Security, LLC, for the Department of Energy's National Nuclear Security Administration

Development of a Platinum-Chromium Alloy for Improved Coronary Stents

Scientists at the National Energy Technology Laboratory (NETL), developed platinum-chromium alloy, a stainless steel formulation with a significant concentration of a highly radiopaque element (platinum) which makes it easier for coronary specialists to see the stent in the catheter during insertion, placement, and expansion. This alloy also increases the stent's corrosive resistance, strength, and flexibility—all of which offer positive benefits to patients and cardiovascular surgeons. The scientists from NETL worked closely with their counterparts from commercialization partner, Boston Scientific Corporation, to perform innovative alloy formulation and primary material process development. Boston Scientific utilized the improved alloy performance to develop new coronary stent products with superior properties compared to existing stainless steel stents. For their efforts, they won a 2012 Excellence in Technology Transfer from the Federal Laboratory Consortium for Technology Transfer. R&D Magazine recognized the team's effort by selecting them as a winner of the 2011 R&D 100 Award.

NETL is part of the U.S. Department of Energy's (DOE) national laboratory system and is owned and operated by the DOE.

Department of Health and Human Services (HHS)

Research at the Department of Health and Human Services is conducted primarily by the Centers for Disease Control and Prevention (CDC), the Food and Drug Administration (FDA), and the National Institutes of Health (NIH).

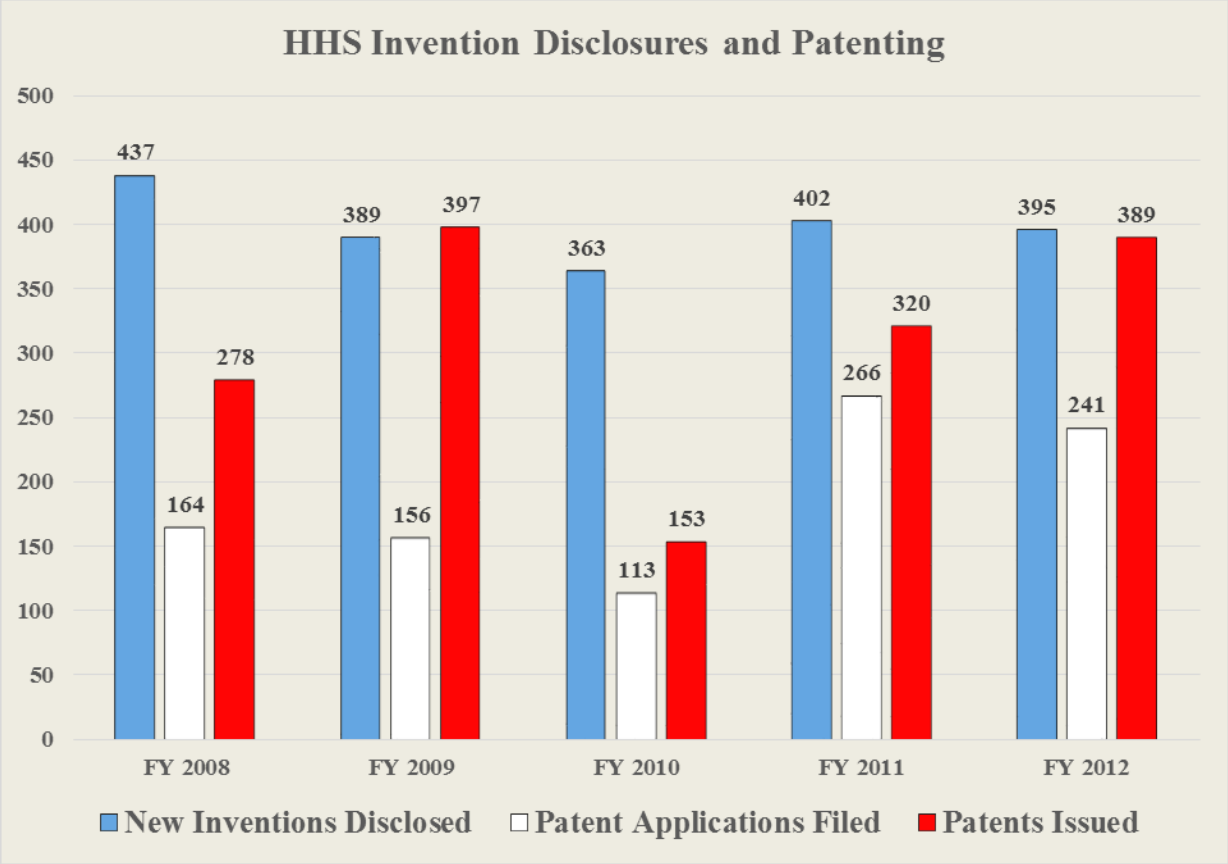
More information about HHS technology transfer activities is available on the following websites:

- CDC: http://www.cdc.gov/od/science/technology/techtransfer;
- NIH: http://www.ott.nih.gov/; and
- FDA: http://www.fda.gov/ScienceResearch/CollaborativeOpportunities /default.htm.

Effectively measuring the public health outcomes that result from such technologies is challenging and complex. Traditionally, efforts to measure the effect of technology transfer activities focus on outputs such as the number of patents and licenses or the amount of royalties generated. However, this approach does not depict the full scope of activities and may, in fact, distort the importance of ensuring that novel biomedical inventions are commercialized.

HHS Invention Disclosures and Patenting

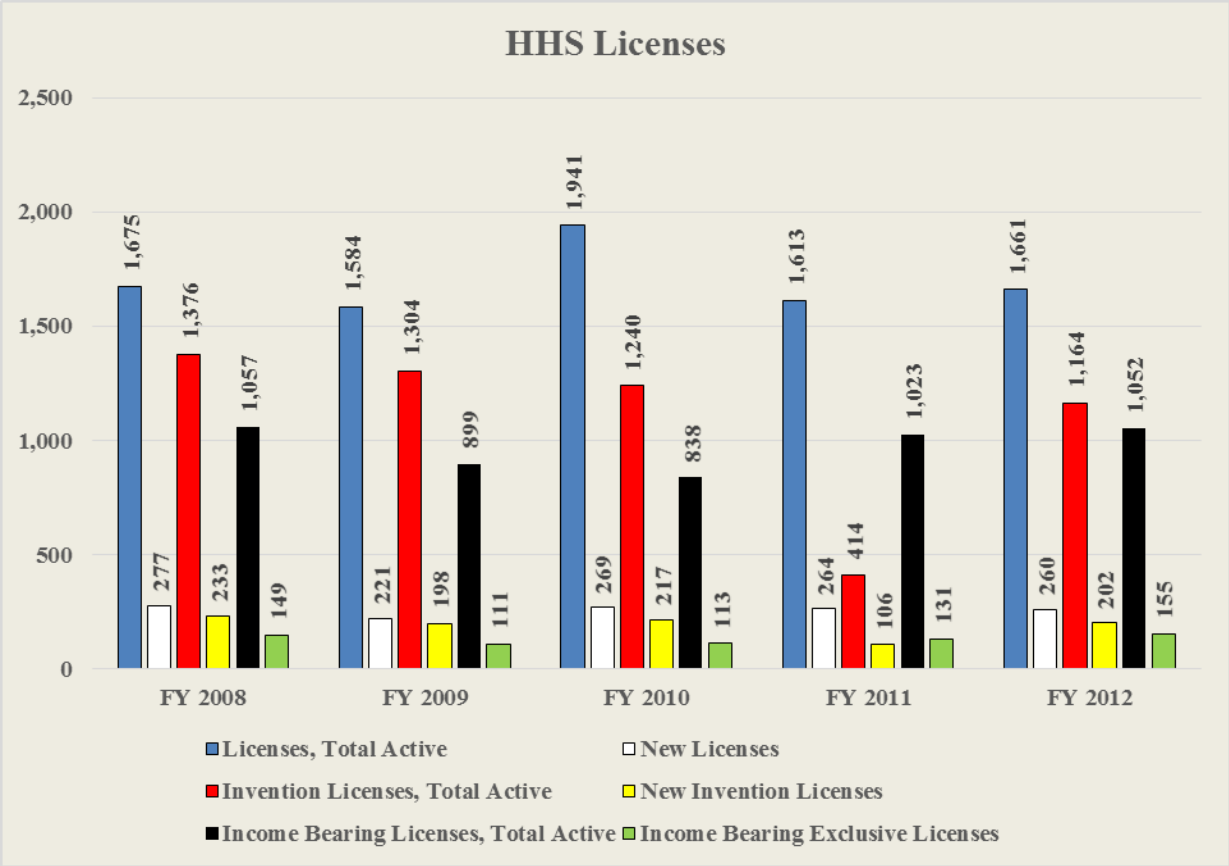
Between FY 2008 and FY 2012, the number of invention disclosures decreased by 10% to a total of 395 in FY 2012. The number of patent applications filed increased by 47%, to 241, while the number of patents issued increased by 40% to 389.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
New Inventions Disclosed	437	389	363	402	395
Patent Applications Filed	164	156	113	266	241
Patents Issued	278	397	153	320	389

HHS Licenses

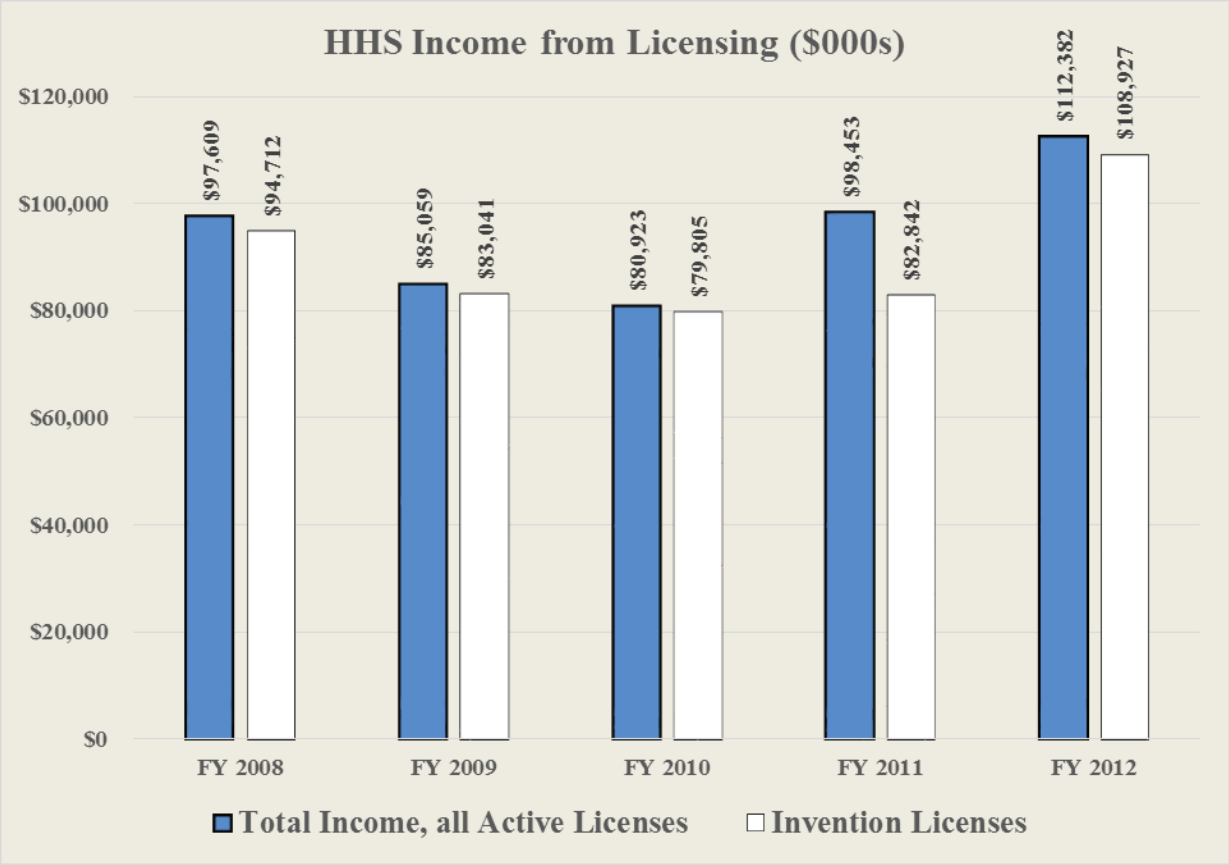
Between FY 2008 and FY 2012, the number of total active licenses decreased by 0.8% to 1,661, and the number of invention licenses declined by 14% to 1,164. The number of income-bearing licenses declined by 0.4% to 1052, while the number of income-bearing, exclusive licenses increased by 4% to a total of 155.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Licenses, Total Active	1,675	1,584	1,941	1,613	1,661
New Licenses	277	221	269	264	260
Invention Licenses, Total Active	1,376	1,304	1,240	414	1,164
New Invention Licenses	233	198	217	106	202
Income Bearing Licenses, Total Active	1,057	899	838	1,023	1,052
Income Bearing Exclusive Licenses	149	111	113	131	155

HHS Income from Licensing

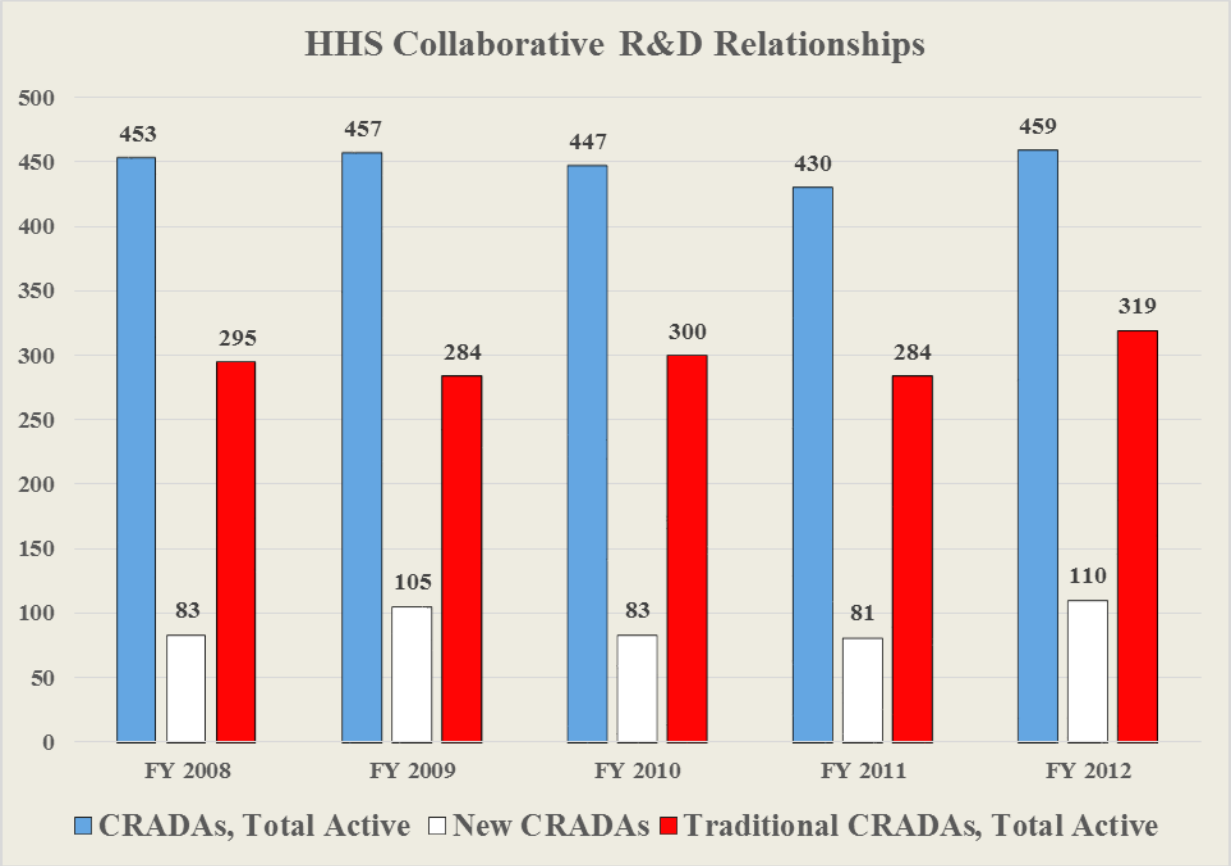
Between FY 2008 and FY 2012, income from all licensing increased by 15% to a total of $112.38 million. During this time period, income from invention licenses increased by 15% to a total of $108.93 million.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Total Income, all Active Licenses	$97,609	$85,059	$80,923	$98,453	$112,382
Invention Licenses	$94,712	$83,041	$79,805	$82,842	$108,927

HHS Collaborative R&D Relationships

Between FY 2008 and FY 2012, the number of active CRADAs increased by 1% to a total of 459 in FY 2012. The number of traditional CRADAs also increased by 8% to a total of 319.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
CRADAs, Total Active	453	457	447	430	459
New CRADAs	83	105	83	81	110
Traditional CRADAs, Total Active	295	284	300	284	319
Other Collaborative R&D Relationships	n/a	n/a	n/a	n/a	n/a

Downstream Success Stories for HHS

High-Performance Instrument for Detection of Infectious Bacteria

Vivione launched its RAPID-B instrument system, a high-performance, integrated infectious disease detection system, developed with FDA technology. Using a multi-dimensional system of analysis, results are obtained faster, with less sample preparation to provide quantitative identification of live viable pathogen within the sample. RAPID-B includes five patented technologies invented by scientists at the Food and Drug Administration (FDA) National Center for Toxicological Research (NCTR) and Center for Drug Evaluation and Research (CDER).

Gene Therapy System Used to Treat Ultra-Rare Genetic Disease LPLD

Adeno-associated virus (AAV), which does not appear to cause harm to humans, has become a useful tool in approaches to treat faulty genes with gene therapy. A normal gene is spliced into the AAV and delivered to a patient's cells to replace a defective gene. National Heart Lung and Blood Institute (NHLBI) scientists at NIH have isolated several strains of the virus to which NIH holds patents. NIH has licensed the virus vector system broadly. UniQure took a non-exclusive license to the AAV vector for use with their proprietary technology resulting in a gene therapy product, Glybera, for treating lipoprotein lipase deficiency (LPLD), an ultra-rare disease. LPLD patients are unable to break down fat molecules resulting in their accumulation in the blood and recurrent acute pancreatitis. Glybera is the first product to treat LPLD and the first gene therapy product to receive European regulatory (EMEA) approval. The U.S. FDA regulatory filing is pending.

Heat Inactivated Rotavirus Vaccine Being Developed to Meet Global Health Needs

Center for Disease Control and Prevention (CDC) scientists have developed a heat inactivated rotavirus vaccine that has been broadly licensed for evaluation and development to companies in the U.S., Europe, China, India and Vietnam. Rotavirus is the single most important cause of severe diarrhea among children throughout the world and is responsible for millions of hospitalizations and an estimated 527,000 deaths per year, with 85% of these deaths occurring in developing countries. Live oral rotavirus vaccines have demonstrated good efficacy against severe rotavirus diarrhea in clinical trials conducted in the Americas and Europe; however, an effective vaccine is most needed in lower income countries. This inactivated rotavirus vaccine is an alternative approach to such live oral vaccines to ensure that the best vaccines are developed for resource-limited settings.

Gene Diagnostic Test for Risk of Developing Cervical Cancer

NIH licensed to Quest Diagnostics a patented diagnostic technology for cervical cancer, the TERC gene marker, invented by scientists at the National Human Genome Research Institute (NHGRI). Under this nonexclusive license, Quest has launched a new test to identify molecular changes to cervical cells that increase the likelihood a woman may develop cervical cancer. Having received results from this test, physicians will be better able to identify women who are at increased risk of developing cancer after receiving unclear results for cervical cancer risk from other standard tests.

Product Showcase of Technologies Brought to Market from NIH Inventions

NIH has created a Product Showcase (http://www.ott.nih.gov/product-showcase) that displays products from its intramural research program utilized every day to detect, treat or prevent disease or assist researchers as they continue to explore ways to develop newer and more effective health care products and procedures. The Showcase includes products that are now or have been in the past on the market. Some are FDA-approved and many are outside the scope of FDA regulations, e.g. those not used in humans or as human diagnostics.

Department of Homeland Security (DHS)

The DHS's Office of Research and Technology Applications (ORTA) is housed in the Science and Technology Directorate. The ORTA is responsible for developing and instituting policies to facilitate technology transfer in accordance with 15 U.S.C. § 3710 throughout DHS and its laboratories. The ORTA's responsibilities include:

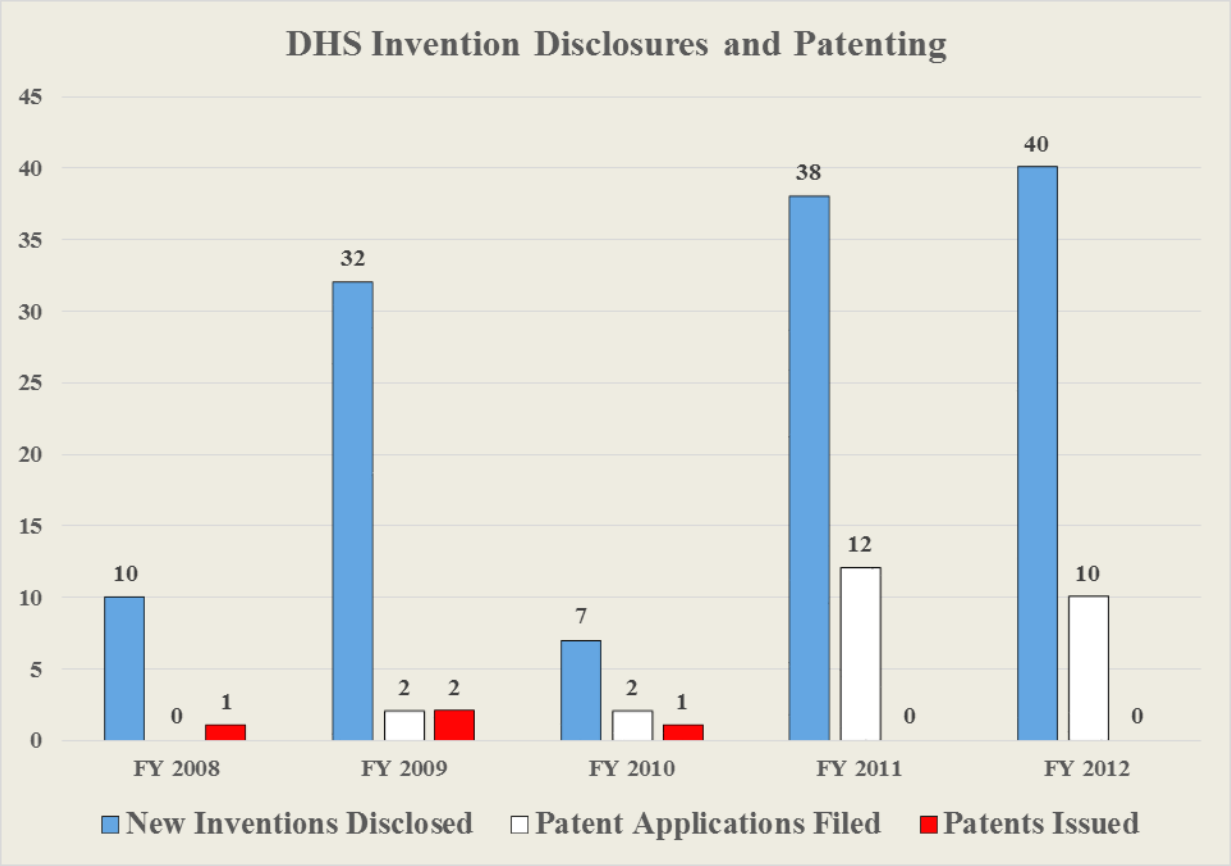
- Standardizing and approving DHS Cooperative Research and Development Agreements (CRADAs), licensing, and other technology transfer agreements;
- Preparing application assessments for selected research and development projects in which the DHS Laboratory is involved and may have commercial application;
- Providing and disseminating information on federally owned or originated technologies which have potential application to State and local governments and private industry;
- Preparing and providing an annual report to Congress and the President through submission to the National Institute of Standards and Technologies (NIST);
- Developing training programs on technology transfer and intellectual property for DHS employees; and
- Establishing an intellectual property program for DHS to track and prosecute patents and other intellectual property, and to develop a royalty and rewards policy.

More information about DHS technology transfer activities is available on the following website:

http://www.dhs.gov/technology-transfer-program.

DHS Invention Disclosures and Patenting

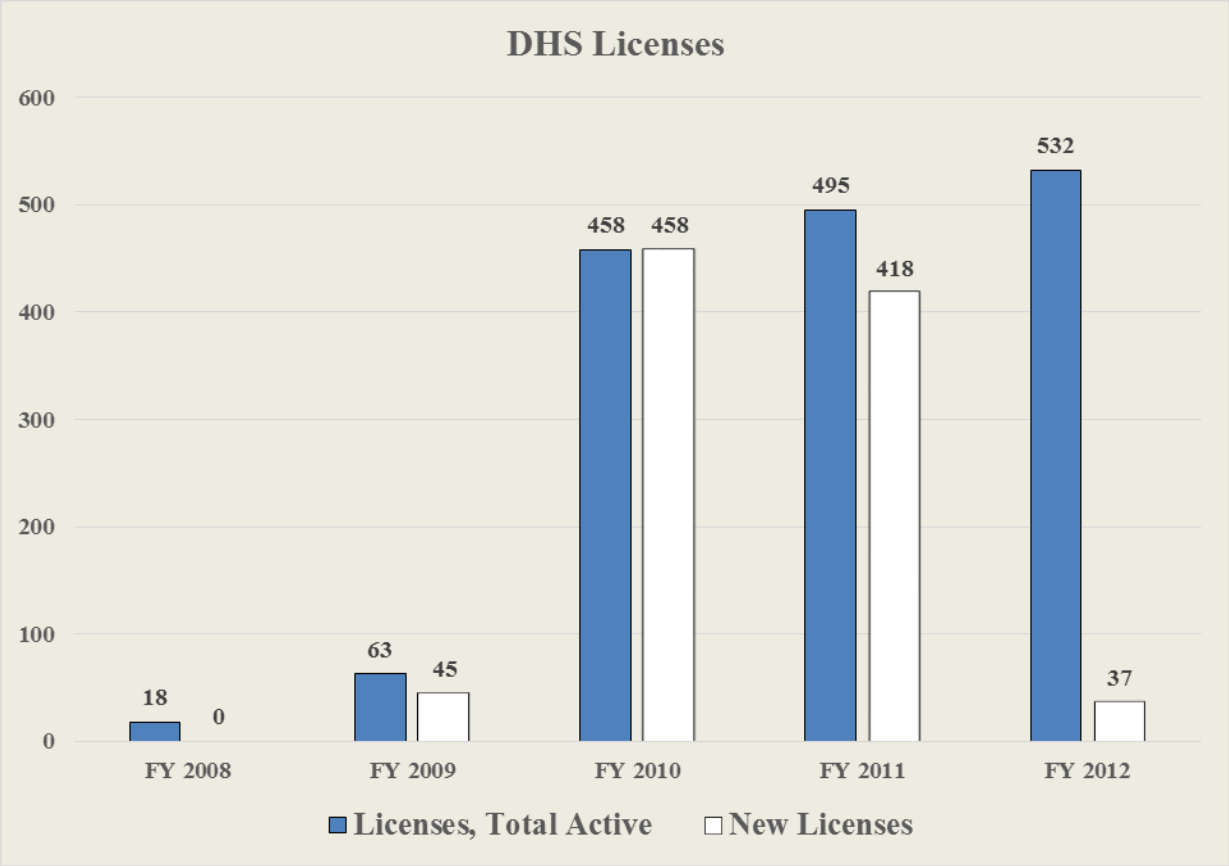
Between FY 2008 and FY 2012, the number of invention disclosures increased by 300% to a total of 40 in FY 2012. The number of patent applications filed, which lags the number of new invention disclosures, increased from 0 to 10. No patents were issued in FY 2011 and FY 2012.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
New Inventions Disclosed	10	32	7	38	40
Patent Applications Filed	0	2	2	12	10
Patents Issued	1	2	1	0	0

DHS Licenses

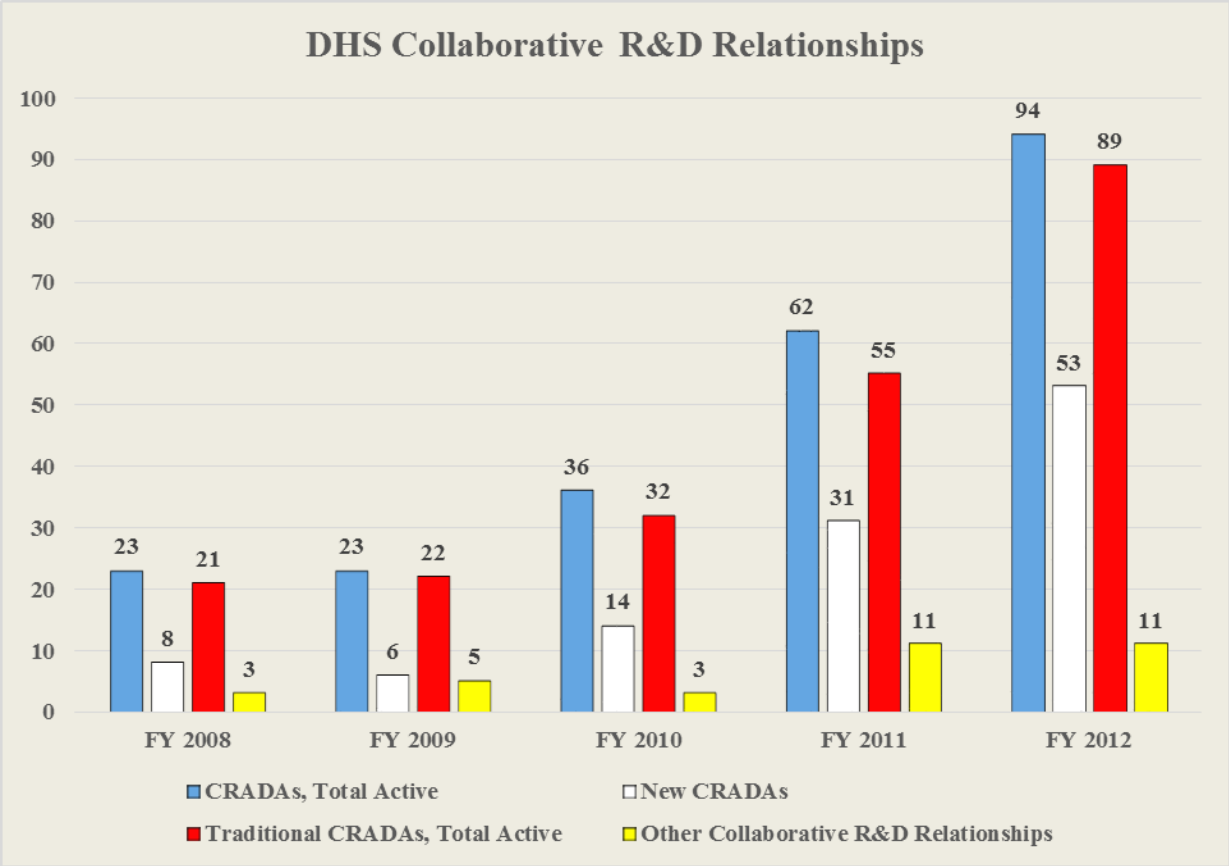
Between FY 2008 and FY 2012, the number of total active licenses increased 18 to 532. No invention licenses or income-bearing licenses were reported.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Licenses, Total Active	18	63	458	495	532
New Licenses	0	45	458	418	37

DHS Licensing Income

DHS reports no licensing income between FY 2008 and FY 2012.



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	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
CRADAs, Total Active	23	23	36	62	94
New CRADAs	8	6	14	31	53
Traditional CRADAs, Total Active	21	22	32	55	89
Other Collaborative R&D Relationships	3	5	3	11	11

Downstream Success Stories for DHS

Radiological Emergency Management System (REMS)

The Radiological Emergency Management System (REMS) is a post-event gamma radiation sensor network designed for response and recovery after an accidental or deliberate release of radiation in an urban area. History has taught that advance planning, coupled with the availability of accurate, real-time information about an emergency incident, can significantly enhance response capabilities. It is to this end that REMS was conceived, pilot-tested, commercialized, and deployed in New York City.

Organized under the U.S. Department of Homeland Security's Science and Technology Directorate, the National Urban Security Technology Laboratory (NUSTL) is a Federal Laboratory located in New York City. The Laboratory formed the idea for REMS shortly after the events of September 11, 2001, when NUSTL scientists and engineers began investigating potential designs for the system.

Over a six-year period, the Lab conducted a pilot of a small REMS network comprising sensors located on rooftops of buildings in Manhattan. The success of the pilot led the New York Police Department (NYPD) to commit to a City-wide implementation of REMS. To support this large-scale deployment, NUSTL's concept and design were commercialized via a CRADA with a major instrument manufacturer. REMS is an allowable equipment expenditure under FEMA's Authorized Equipment List and so DHS funds can be used for acquisition by NYPD or other state/local/tribal/territorial agency.

Currently, numerous REMS sensors are installed on buildings throughout the City in a staged deployment. Each sensor in the REMS network continuously measures environmental radiation levels and sends real-time data to a central command center. REMS sensors also provide gamma spectroscopy data used to identify the isotope responsible for the radiation. In the event of a radiation release, the system provides emergency managers with a single picture of the threat early in the incident. Specifically, the system informs emergency managers of radiation levels before responders enter an affected area, provides guidance on which areas to evacuate versus shelter-in-place, and offers officials timely information about potential radiation exposure. By communicating exposure information to the public early on, officials can reduce unnecessary evacuations and panic. Additionally, data from REMS can be used to predict the path of a radioactive plume when integrated with an atmospheric plume dispersion model, enabling advance warning to affected areas. Not only does REMS serve life-saving purposes, but the system also enables economic recovery by preventing unnecessary evacuations and expediting the return of residents to areas of the City that are deemed safe.

NYPD currently owns and operates its own REMS network, for which NUSTL continues to provide technical expertise and services in support of system implementation and operation. NUSTL performs independent testing of the sensors before they are installed and has developed a comprehensive test plan to ensure proper operation of the sensors, communications, and system software. NYPD considers NUSTL to be a valuable and essential partner, and Laboratory staff often advises them on issues from the selection of optimal sensor locations to the advanced interpretation of radiation data during an emergency. The successful partnership experience of NUSTL and New York City with REMS provides a model for expansion of post-event radiation detection systems to other cities.

Transportation Security Laboratory (TSL) Innovation Initiative

The Transportation Security Laboratory (TSL) Business Office launched an initiative to capture intellectual property and encourage a culture of innovation at TSL. TSL's Technology Transfer Specialist worked with an attorney loaned by the Science and Technology Directorate to identify 34 patent initiatives during 2011-2012. TSL's efforts in technology transfer were recently recognized by the Federal Laboratory Consortium (FLC): TSL was selected as the winner of the 2012 FLC Northeast Region Laboratory Award, which recognized extraordinary efforts, which exceed legislated requirements, in the furtherance of national and regional technology transfer activities. A panel of technology transfer experts from the FLC chose TSL's nomination as the best example of technology transfer at work in the region.

TSL has formalized a new process to aid industry in the development of technology. TSL's Technology Optimization Partnerships (TOPs) process is a public-private partnership designed to expedite the maturation and deployment of technologies. The TOPs-centered improvement to TSL processes and the new emphasis on technology transfer has increased the number of TSL CRADAs. TSL has increased the number of collaborative agreements with partners throughout the Nation and with foreign enterprises.

In support of the Technology Transfer Program, the Director of the TSL provided a dedicated TSL employee to work on Technology Transfer not only with industrial partnerships, but with technology developed by personnel within the Transportation Security Laboratory. An initial step taken was to develop a partnership with the S&T legal team for a member to come to the TSL frequently to educate the scientists and engineers on the legal requirements for patents, inventions, and disclosures such that intellectual property could be protected, shared, and commercialized. Several group and individual meetings have been and continue to be held with the technical team at TSL to initiate invention/disclosure process. The TSL provided incentives for filing patent disclosures to TSL scientists, and helped foster the sense of accomplishment and prestige associated with disclosure. TSL has identified 34 patent initiatives during the last year, which was a 600% increase from the previous year. This includes intellectual property ranging from novel methods to interface orthogonal explosives detection technology for better detection, to the development of suites of non-toxic, inert explosive simulants that can be used for a wide variety of technologies, to novel methods for stand-off detection of explosives using active millimeter waves, and new sampling devices designed to sample trace amounts of explosive residues from shoes or shipping containers.

Foot-and-Mouth Disease Vaccine Cooperative Research and Development Agreement

The Department of Homeland Security's Science and Technology Directorate (DHS S&T) Plum Island Animal Disease Center (PIADC) entered into a Cooperative Research and Development Agreement (CRADA) with Inovio Pharmaceuticals to assess Foot-and-Mouth Disease (FMD) synthetic vaccines' potential to help ensure U.S food supply safety. Inovio's patented SynCon® vaccines cannot cause FMD, thus providing a safe approach to potentially protect against FMD and reduce its serous impact on global food supply and commerce. Leveraging Inovio's SynCon® vaccines in combination with Inovio's proprietary CELLECTRA® vaccine delivery method to advance infectious disease and cancer products for human medicine, the DHS S&T -PIADC CRADA goal is to rationally design and evaluate SynCon® FMD vaccines to protect swine against FMD.

As a result of this ongoing partnership, key milestones were achieved during FY12:

- DHS S&T PIADC and Inovio scientists designed SynCon® FMD vaccine candidates for two different FMD virus serotypes; and
- Initial studies in mice demonstrate SynCon® FMD vaccine candidates induced functional immune responses in mice.

The FMD SynCon® vaccine candidates are currently undergoing proof-of-concept efficacy studies in the DHS S&T PIADC BSL-3 containment facilities. If successful, this DNA vaccine-based technology (using the CELLECTRA® vaccine delivery system previously approved for use in swine) will be the focus of strong commercial interest from global veterinary medicine biopharmaceutical companies interested in manufacturing next generation FMD vaccine without the need for high biocontainment production facilities.

Department of the Interior (DOI)

Technology transfer for DOI includes a range of activities designed to disseminate scientific and technical information and knowledge between DOI and other Federal and non-federal entities. It includes but is not limited to: publications, exchange of scientific and technical information, protecting and licensing intellectual property rights, and sharing (or otherwise making available for scientific or technical purposes) the expertise and specialized scientific material and resources which DOI manages. In general, technology transfer activities within DOI are consistent with its mission to protect and manage the Nation's natural resources and cultural heritage; to make available scientific and other information about those resources; to honor trust responsibilities to Tribes; and to supply energy for the future.

The FY 2012-enacted budget for DOI included $822.2 million for research and development. Much of the funding was for applied research ($650.9 million), while basic research and development received $55.5 million and $115.8 million, respectively. The programs supported through these funds generate large amounts of knowledge, information, and technology, which help Interior meet its mission objectives and are transferred to resource managers, stakeholders, and the general public.

DOI's bureaus have varying levels of involvement with scientific and technical research and innovation, and technology transfer. In FY 2012, as in previous years, the majority of technology transfer activities being reported by the Department under the Federal Technology Transfer Act of 1986 (FTTA), was undertaken by the U.S. Geological Survey (USGS). It is the largest R&D organization within DOI, both in terms of budget and personnel, and typically accounts for 80% of DOI's R&D budget.

DOI's scientists, engineers and other technical personnel advance the state of knowledge related to DOI's resources, and ensure that this information is accessible to resource managers, private industry, and the general public. The vast majority of DOI's technology transfer activities use traditional technology transfer mechanisms such as publications of peer-reviewed papers and reports, webpage postings, and presentations at meetings and conferences. In 2012, USGS and U.S. Fish and Wildlife Service (FWS) personnel, for example, authored or co-authored over 2,300 reports, books, fact sheets, and other publications, including over 1,300 scientific journal articles. Bureaus also use other conventional approaches to share scientific and technical resources and expertise with each other, universities, and other entities to address resource management issues. For example, several are active participants in the network of Cooperative Ecosystem Studies Units (CESUs), a collaboration among 13 Federal agencies (including six DOI bureaus) and over 300 non-federal partners (including universities, Tribes and tribal organizations, State agencies, museums, aquariums, arboretums, and conservation organizations) organized into 17 CESUs, each hosted by a university.

Bureaus that are active in research and development, or have research capabilities that complement U.S. commercial interests, may also utilize technology transfer agreements authorized by the FTTA to join forces with non-federal partners. Such agreements allow DOI's bureaus and private sector industries to pool their expertise and resources to jointly create and advance technologies that help fulfill agency missions while helping U.S. industries innovate and commercialize technologies that can strengthen our national economy and create jobs. This report focuses primarily on the aspects of technology transfer related to the FTTA.

Departmental Plan on Technology Transfer

In response to the 2011 Presidential Memorandum, DOI submitted a plan in 2012 that commits to:

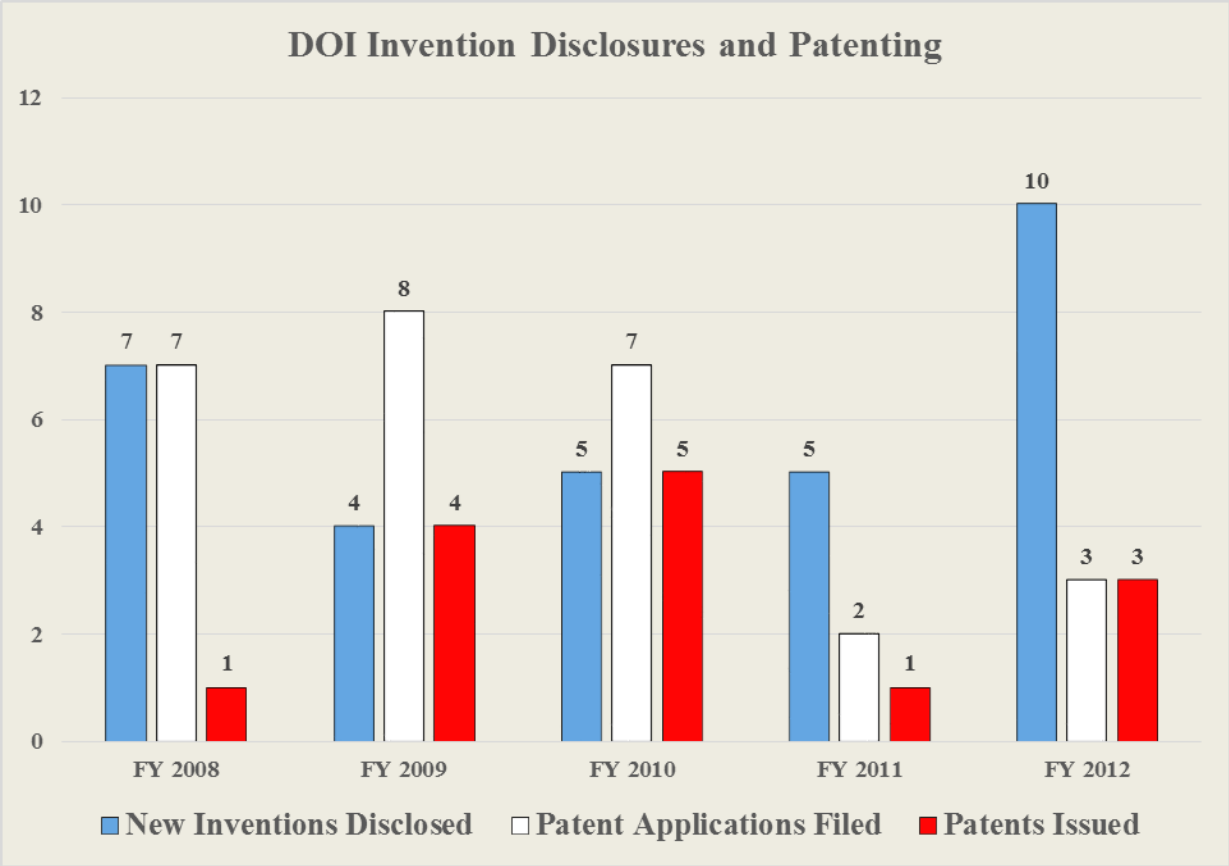
- Developing a Departmental Manual chapter specifying general policies for implementing technology transfer activities authorized by the FTTA, and related legislation;
- Revising the current Departmental Manual chapter on patents and inventions that dates to the 1980s;
- Developing an online repository of documents and legal templates detailing best practices for technology transfer agreements and activities from around the government and elsewhere;
- Submitting annually to OMB consolidated reports on technology transfer activities and achievements, including analysis of trends in these activities;
- Developing a unified website to improve public access to information related to inventions owned by the various bureaus, and other technology transfer activities; and
- Developing materials to train bureau R&D personnel in technology transfer activities, including training on relevant ethics and legal issues.

More information about DOI technology transfer activities is available at

http://www.doi.gov/techtransfer/index.cfm.

DOI Invention Disclosures and Patenting

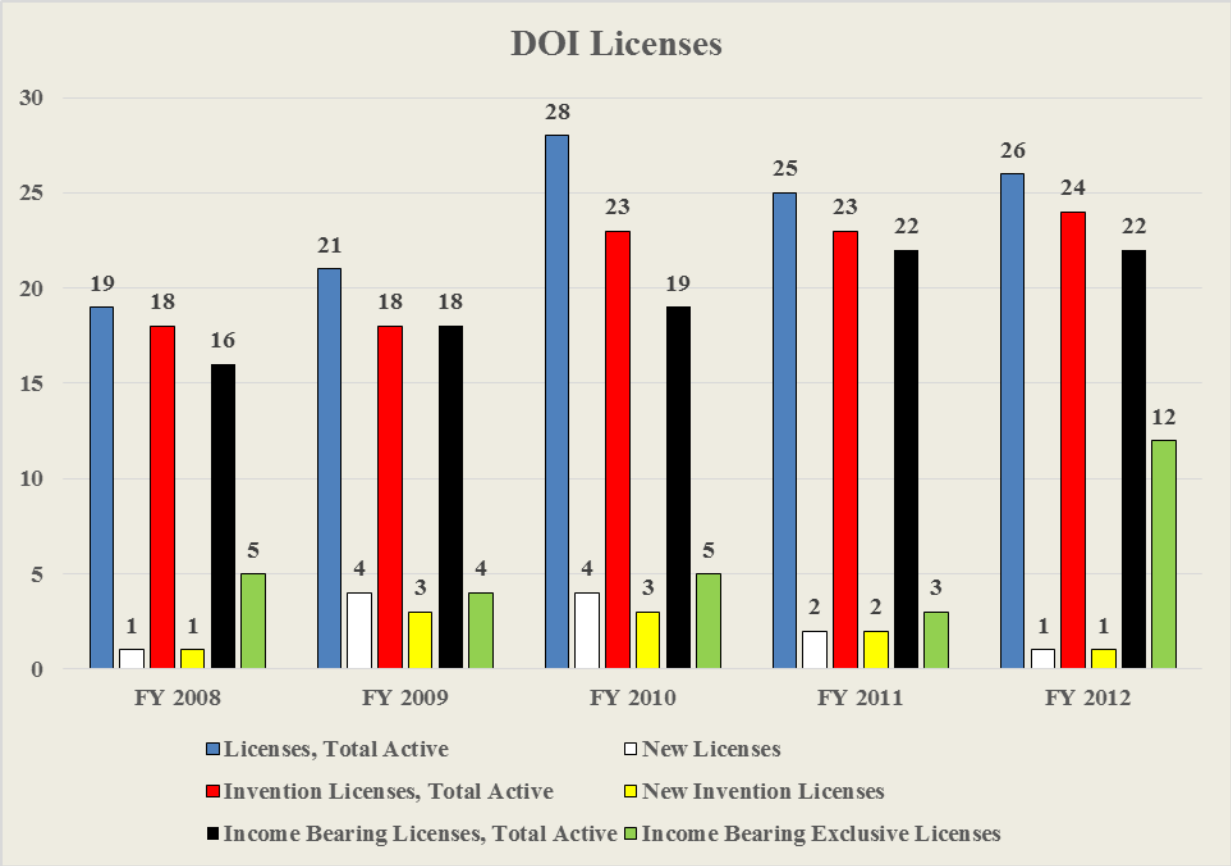
In FY 2012, DOI reported 10 invention disclosures, 3 patent applications filed, and 3 patents issued.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
New Inventions Disclosed	7	4	5	5	10
Patent Applications Filed	7	8	7	2	3
Patents Issued	1	4	5	1	3

DOI Licenses

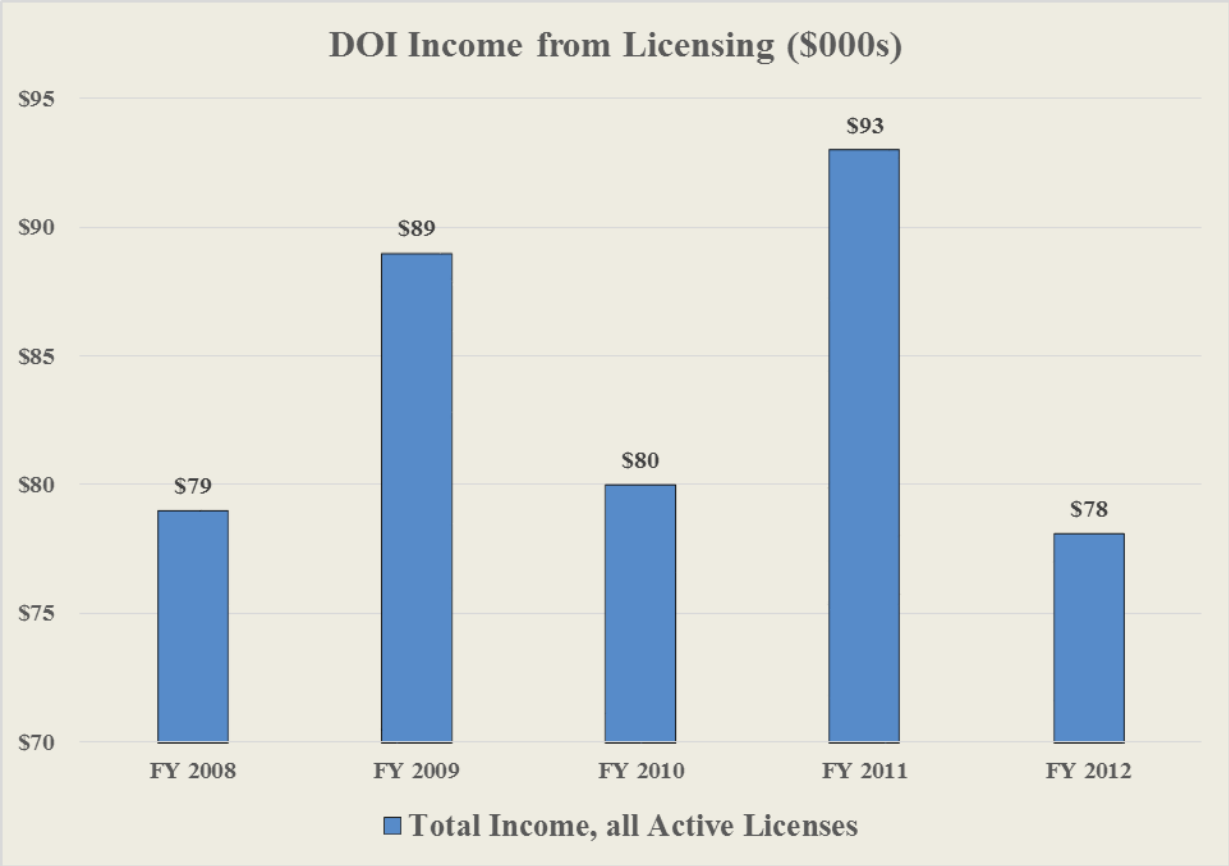
Between FY 2008 and FY 2012, total active licenses increased by 37% to 26, invention licenses increased by 34% to 24, income-bearing licenses increased by 38% to 22, and exclusive income-bearing licenses increased by 140% to 12.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Licenses, Total Active	19	21	28	25	26
New Licenses	1	4	4	2	1
Invention Licenses, Total Active	18	18	23	23	24
New Invention Licenses	1	3	3	2	1
Income Bearing Licenses, Total Active	16	18	19	22	22
Income Bearing Exclusive Licenses	5	4	5	3	12

DOI Income from Licensing

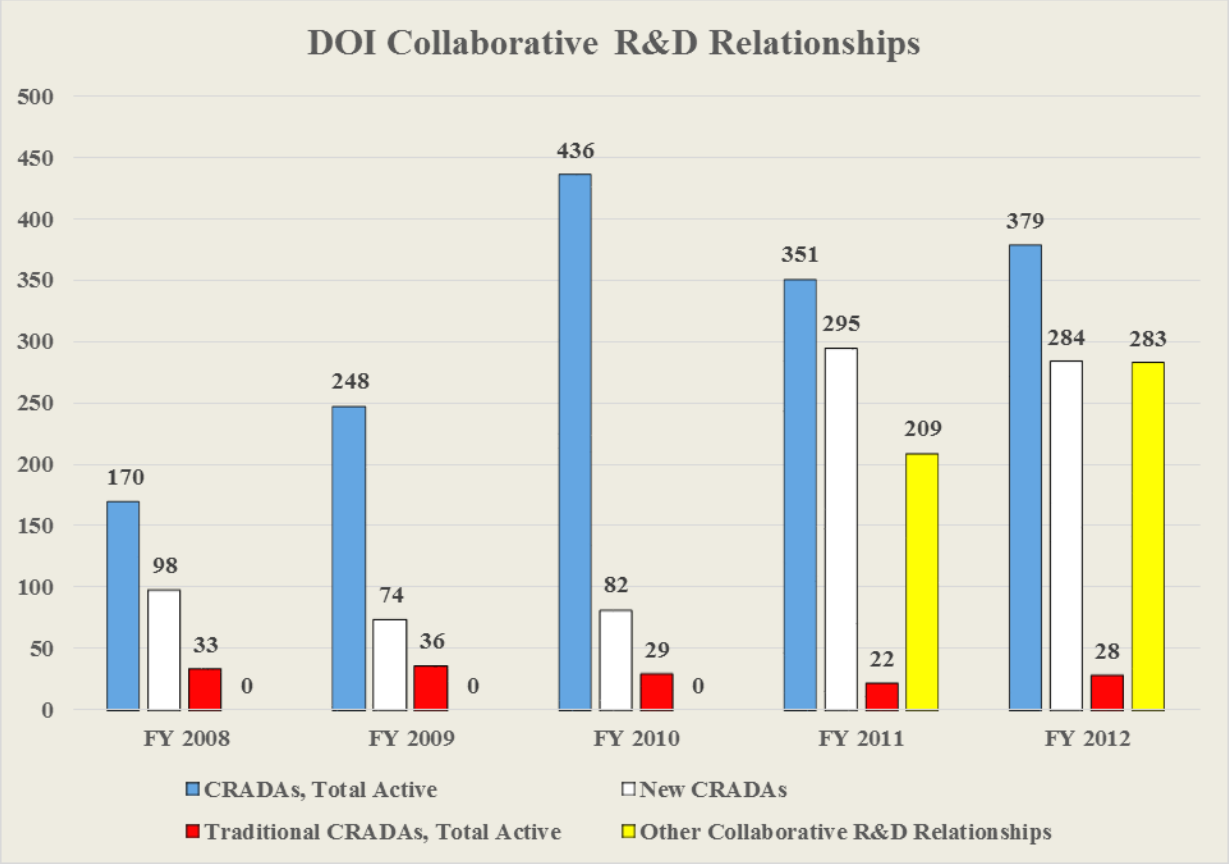
Between FY 2008 and FY 2012, DOI reported a 1% decrease in total income to $78,000.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Total Income, all Active Licenses	$79	$89	$80	$93	$78
Invention Licenses	$79	$89	$80	$93	$78

DOI Collaborative R&D Relationships

Between FY 2008 and FY 2012, DOI reported a 123% increase in the number of active CRADAs to a total of 379 in FY 2012. During this period, the number of traditional CRADAs declined by 15% to a total of 28, while the number of other, non-CRADA collaborative R&D relationships in FY 2012 was 283.[20]



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
CRADAs, Total Active	170	248	436	351	379
New CRADAs	98	74	82	295	284
Traditional CRADAs, Total Active	33	36	29	22	28
Other Collaborative R&D Relationships	0	0	0	209	283

[20] Other Collaborative R&D Relationships were not reported prior to FY 2011

Downstream Success Stories for DOI

Improving Earthquake Hazard Assessments

The USGS Earthquake Program has a long running CRADA with the Pacific Gas and Electric Company (PG&E), a publicly regulated utility providing service within California, to help reduce the impact of future earthquakes on the performance of the latter's gas and electric systems, and to maintain acceptable levels of customer service. The PG&E CRADA, which complements the USGS Earthquake Program, is carried out using the capabilities of five USGS Science Centers (Earthquake, Geology and Geophysics, Pacific Coastal and Marine, California Water, and Geologic Hazards). In one particular project under the CRADA, the USGS and PG&E produced new geophysical data as part of the Diablo Canyon Power Plant (DCPP) Long Term Seismic Program. Following identification of the Shoreline fault zone offshore the DCPP in 2008, PG&E embarked on a two-year study to more completely evaluate the geologic and seismologic characteristics of the Shoreline fault zone and assess the ground motion hazard at the DCPP. The data and results were reported by PG&E to the U.S. Nuclear Regulatory Commission (NRC) in 2012. The researchers are now performing re-assessments of hazards with the NRC.

Treating Flesh-Eating Bacteria

The USGS co-owns with Arizona State University an invention relating to synthetic antibacterial compositions having clay-like properties and a method of using these compositions to topically treat skin infections and skin diseases caused by certain types of bacteria, including antibiotic-resistant bacteria. The clay composition kills the bacteria or compromises their ability to grow or reproduce.

Conventional antibiotics have been increasingly ineffective at treating certain bacterial infections of the skin due to resistant bacteria. Past studies have documented the use of natural, medicinal clays in the Ivory Coast for effectively counteracting Buruli ulcers, which are caused by flesh-eating bacteria. This suggests that medicinal clays may provide a means of effectively counteracting skin bacterial infections. While earlier studies indicated that the flesh-eating bacteria succumbed to a type of medicinal clay, specific guidance to identify which clays possess antibacterial properties was lacking, as was an understanding of the mechanism behind the clay's antibacterial activity. The inventors studied many different natural clays and clay minerals to determine factors that make clay toxic to bacteria. Through extensive research, the inventors identified a reducing agent (pyrite) and the concentration at which, in fine particle form, it renders certain natural clays antibacterial. This invention provides a method for identifying a natural clay having bactericidal activity in its natural form and provides formulations of reducing agents such as pyrite and marcasite and clays to impart a bactericidal effect.

In FY 2012, USGS continued to experiment with clays by transforming non-therapeutic clay into therapeutic clay, which was provided free to third parties in exchange for feedback on its efficacy. Anecdotal information suggests that it may be effective for treating horses infected by flesh eating bacteria.

Rapid Mapping and Characterization of Hydrocarbon and Dispersant Plumes in Seawater

The April 2010 Deepwater Horizon oil spill in the Gulf of Mexico highlighted the need for tracking undersea hydrocarbon plumes and understanding their impacts over the long term. At present, there is no good method of tracking the remnants of such huge pollution events or their long term impacts, since divers can rarely descend below 100 meters, and visibility via remotely-operated underwater vehicles is poor. In addition, there are over 6,600 active or removed oil platforms in the Gulf of Mexico alone and each connects to a huge

network of pipelines lying on or just below the seafloor. Many of them are old, corroded, or damaged by hurricanes and are known to be leaking. To protect coastline and marine environments, new technologies are needed to detect, map, and characterize undersea hydrocarbon plumes and to predict their movements.

The USGS owns an invention that tracks undersea hydrocarbon plumes by using oil's ability to serve as a dielectric insulator. A voltage applied across a dielectric insulator induces a charge in the latter. The magnitude of this charge depends on the "capacitance" of the dielectric. [The capacitance is a measure of the electrical charge that can be induced per volt applied.] A mixture of seawater and oil also serves as a dielectric. The greater the dispersal of the hydrocarbons in the seawater the greater the induced charge. An oscillating voltage signal in polluted seawater causes a varying response whose frequency depends on the size and density of the oil droplets.

The measurement device consists of a towed electrical transmitter-sensor streamer array having three or more streamer cables that is pulled through the water column at three or more depths to detect hydrocarbons in the seawater column by measuring seawater capacitance. This permits immediate development of detailed maps measuring seawater capacitance, such that hydrocarbon plumes in seawater can be mapped and characterized, including their location and movement, for better environmental control and management.

Following successful laboratory studies that indicate that variations of this method can be used to efficiently map hydrocarbon plumes in 3-D in the deep ocean. The device is now being further tested under a Technical Assistance Agreement with Williamson & Associates, Inc. of Seattle, WA and Zonge International, Inc. of Tucson, AZ.

Water Purification Technologies

Ensuring access to the quantity and quality of water needed to support growing economies, societies, and overall quality of life is a national and international challenge. New and improved desalination technologies are central to meeting this challenge. U.S. industries are currently world leaders in manufacturing desalination technologies. Desalination technologies are not only tools to convert seawater into useable waters, but also to treat traditional and non-traditional sources of inland waters for a variety of uses. Pooling the know-how and research capacity of Federal and U.S. private sector companies is vital to maintaining and growing the U.S.'s world-wide leadership position in this vital area and meeting the growing needs for water in the U.S. and abroad.

During 2012, Reclamation entered into a Material Transfer Agreement (MTA) with Dow Chemical Company (Dow) to evaluate Reclamation's recently patented desalination membrane to purify water while resisting chlorine degradation. A significant deficiency of industry-standard desalination membranes is their poor ability to resist chlorine degradation. This is important because chlorine dosing is vital to the water treatment process in order to prevent membrane biofouling. Chlorine is also commonly found in the water that has to be treated by desalination membranes.

Under the agreement, Reclamation provided Dow with its patented chemical membrane formulation to manufacture a set of full-scale membranes for prototype testing. Dow provided their manufacturing know-how and capability to scale-up the Reclamation formulation into the full size membranes and also provided a set of the current Dow industry-standard membranes for comparison testing. The membranes were tested by Reclamation at Reclamation's Yuma Area Office-Water Quality Improvement Center. Results indicate the new

Reclamation formulation performed well, but did not exceed that of the Dow industry standard. The patented Reclamation formulation has many derivations and patent applications for additional new formulations were filed by Reclamation during 2012. Reclamation and Dow are now considering an expanded collaborative agreement to jointly evaluate and test a broader spectrum of Reclamation's formulations.

Controlling Invasive Mussels

Starting in 2009, Reclamation partnered with Marrone Bio Innovations (MBI) under a Cooperative Research and Development agreement (CRADA) to test and improve Marrone's molluscicide — Zequanox® — a biopesticide product made from a dead, naturally occurring soil microbe called *Pseudomonas fluorescen. Controlling quagga mussels that have recently invaded the Colorado River and other western water bodies is a high priority for Reclamation and other Western water managers. These mussels have clogged many closed-system water delivery and cooling systems across the network of Reclamation and other western water storage and delivery infrastructure.* Under the CRADA, MBI funded Reclamation to help test multiple formulations of Zequanox in closed water systems at Davis Dam on the Colorado River during FY2012. The CRADA objective was to fine-tune product formulations, delivery systems, and application rates under prototype field conditions to accelerate the development of a commercial product that could be transferred and deployed across typical water infrastructure and operational settings. Reclamation's CRADA contributions included the use of facilities and expert assistance from Reclamation's quagga mussel research team to collaborate with the MBI research staff.

In FY 2012, the U.S. Environmental Protection Agency (EPA) approved a dry formulation of Zequanox® under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) as an EPA registered biological product for controlling invasive mussels within enclosed systems and infrastructures (registration number 84059-15)**.** The objective of FIFRA is to provide Federal control of pesticide distribution, sale, and use. All pesticides used in the United States must be registered by EPA. Registration assures that pesticides will be properly labeled and that, if used in accordance with specifications, they will not cause unreasonable harm to the environment. Use of each registered pesticide must be consistent with use directions contained in any labeling.

Department of Transportation (DOT)

DOT is the Federal steward of the Nation's transportation system. DOT consists of multiple modal Operating Administrations, which carry out mission-related Research, Development and Technology (RD&T) programs in support of the DOT strategic goals: Safety; Livable Communities; State of Good Repair; Economic Competitiveness; and Environmental Sustainability. In 2004, the Research and Innovative Technology Administration (RITA) was charged by its enabling legislation (Public Law 108-426, November 30, 2004 (118 STAT. 2423)) with coordination of DOT-wide RD&T and technology transfer activities. In the Omnibus Bill of 2014, RITA was elevated to the Office of the Secretary and given a new name – the Office of the Assistant Secretary for Research and Technology.

Technology Transfer activities are executed by the following DOT laboratories:

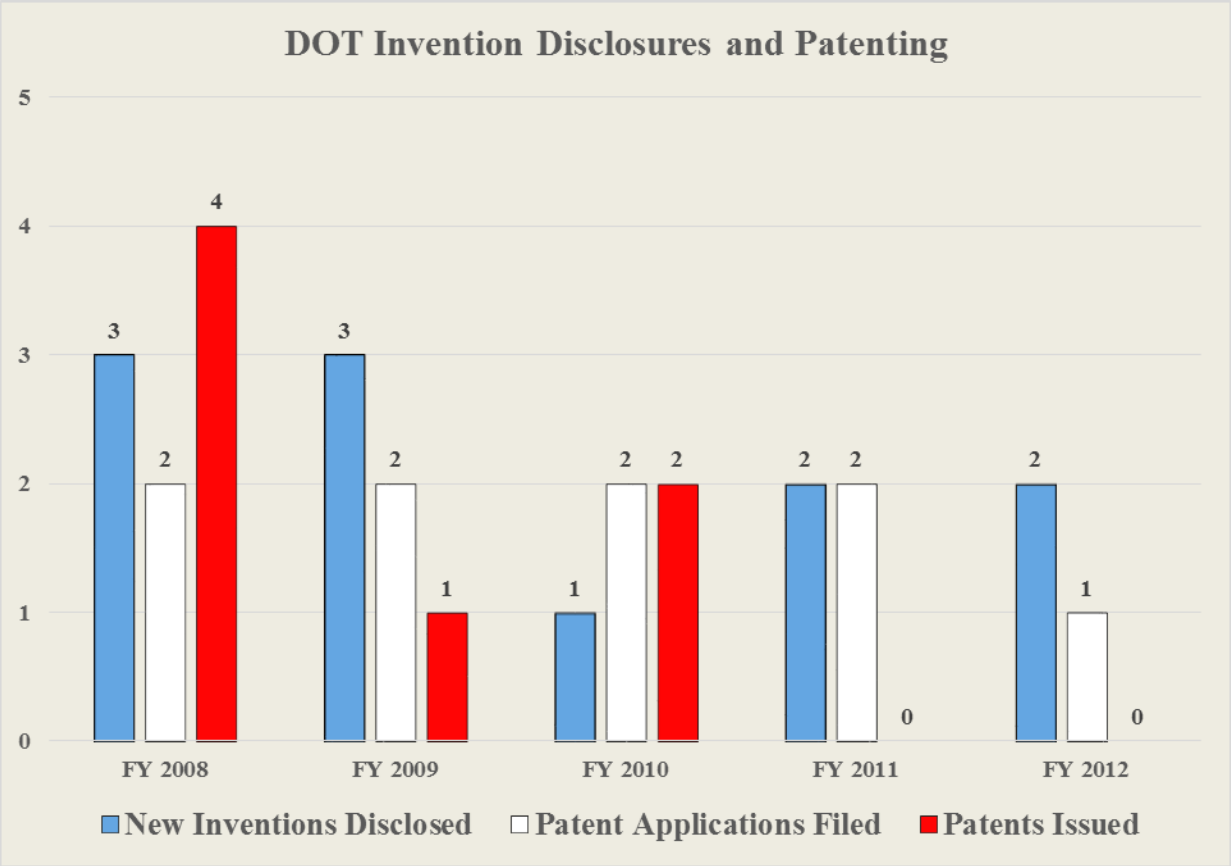
Federal Aviation Administration (FAA): The FAA's Federal laboratory is the William J. Hughes Technical Center located at the Atlantic City International Airport, New Jersey; Federal Highway Administration (FHWA); The FWHA's Federal laboratory is the Turner-Fairbank Highway Research Center (McLean, VA); Office of the Assistant Secretary for Research and Technology; and the John A. Volpe National Transportation Systems Center (Volpe Center, Cambridge, MA).

More information about DOT technology transfer activities is available on the following websites:

- FAA http://www.faa.gov/about/office_org/headquarters_offices/ang/offices /tc/initiatives/ttp/;
- FHWA http://www.fhwa.dot.gov/everydaycounts/; and
- OST http://www.volpe.dot.gov/ourwork/techtrns.html.

DOT Invention Disclosures and Patenting

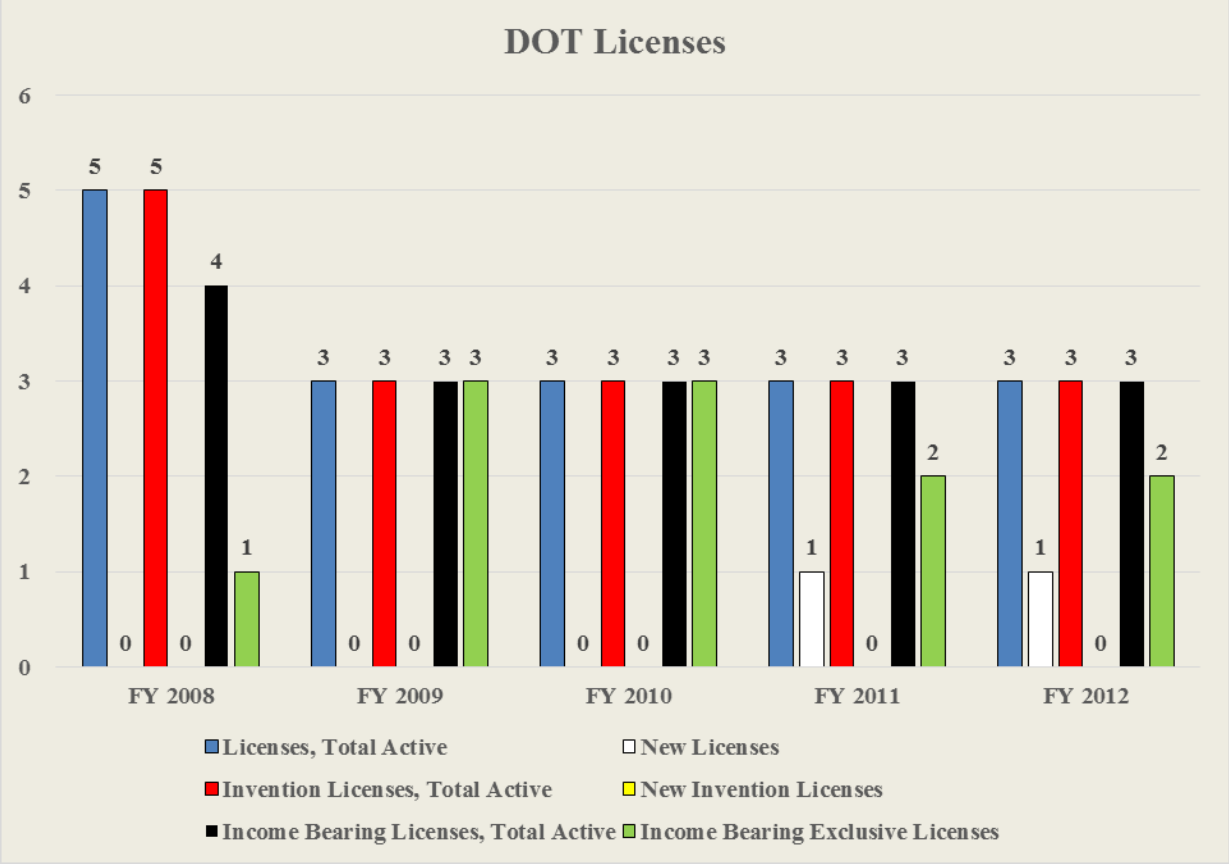
DOT reported two new invention disclosures and one patent application filed in FY 2012.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
New Inventions Disclosed	3	3	1	2	2
Patent Applications Filed	2	2	2	2	1
Patents Issued	4	1	2	0	0

DOT Licenses

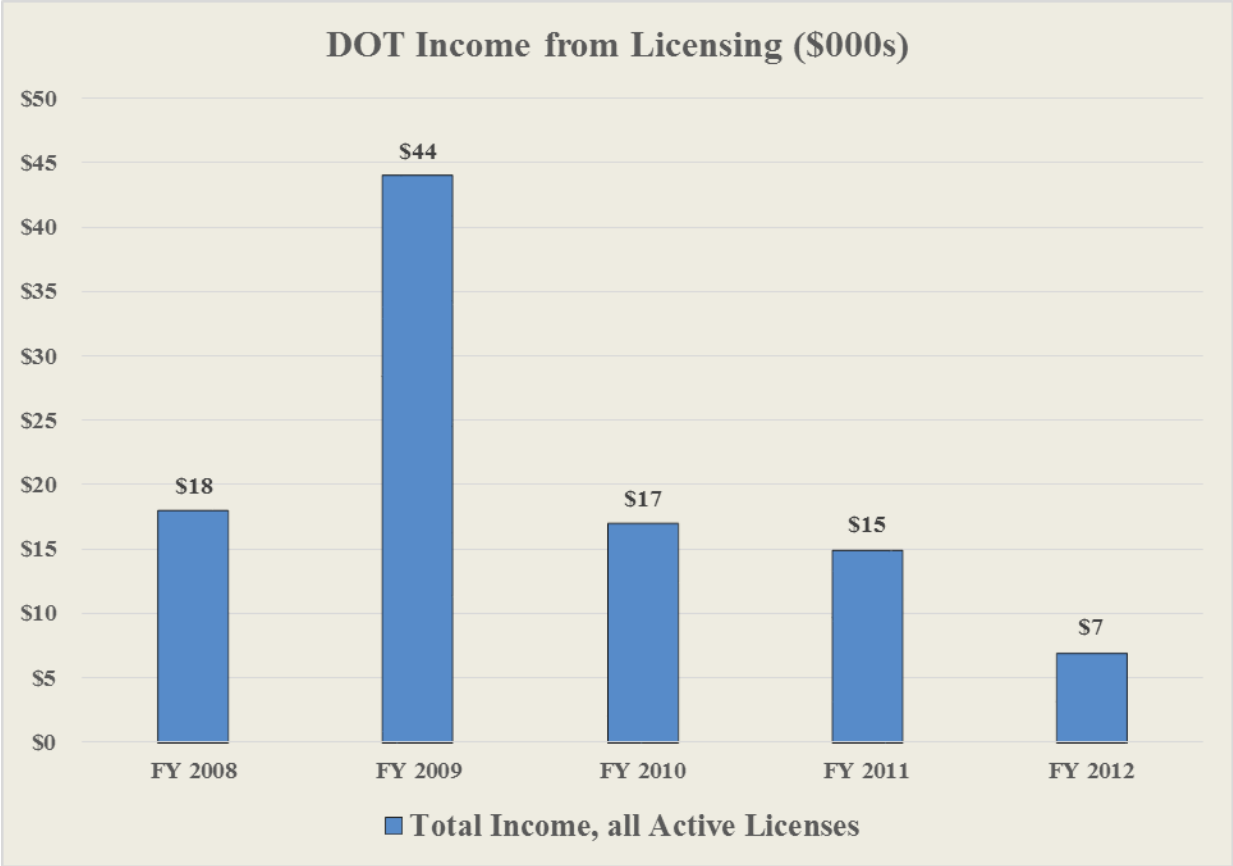
DOT reported three active, income-bearing licenses, two of which are income-bearing, exclusive licenses.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Licenses, Total Active	5	3	3	3	3
New Licenses	0	0	0	1	1
Invention Licenses, Total Active	5	3	3	3	3
New Invention Licenses	0	0	0	0	0
Income Bearing Licenses, Total Active	4	3	3	3	3
Income Bearing Exclusive Licenses	1	3	3	2	2

DOT Income from Licensing

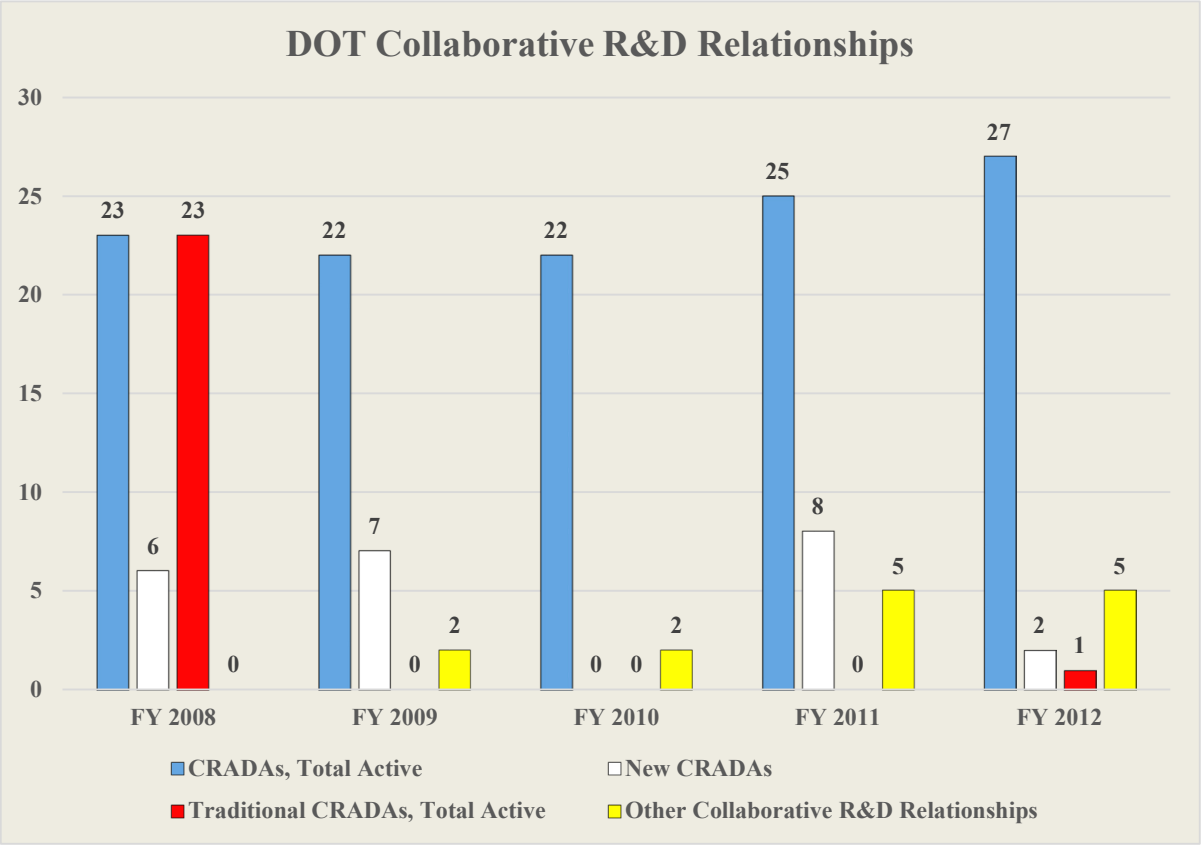
DOT reported $7,000 in income from active licenses in FY 2012.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Total Income, all Active Licenses	$18	$44	$17	$15	$7
Invention Licenses	$18	$44	$17	$15	$7

DOT Collaborative R&D Relationships

DOT reported 27 active CRADAs in FY 2012.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
CRADAs, Total Active	23	22	22	25	27
New CRADAs	6	7	0	8	2
Traditional CRADAs, Total Active	23	0	0	0	1
Other Collaborative R&D Relationships	0	2	2	5	5

Downstream Success Stories for DOT

FAA Launches Research Agreement to Address Radio Spectrum Congestion

The Federal Aviation Administration's (FAA) Technology Transfer Program recently established a Cooperative Research and Development Agreement (CRADA) with SELEX Systems Integration Inc. (SELEX), of Overland Park, Kansas, to address the growing problem of radio frequency spectrum congestion.

As the FAA migrates from the current NAS to the Next Generation Air Transportation System (NextGen) environment, increasing demands are being placed on spectrum in frequency bands used by Automatic Dependent Surveillance-Broadcast (ADS-B) and secondary surveillance radar. Communications for all these integral systems use the 1030/1090 MHz frequency band. The FAA identified 1030/1090 MHz radio spectrum congestion as a significant risk to the future of the ADS-B program, NextGen, and other safety-

critical systems. The secondary radar surveillance systems that rely on 1030/1090 MHz frequency bands of the spectrum include: Air Traffic Control Beacon Interrogator Model 5 (ATCBI-5), ATCBI-6 and Mode-Select (Mode-S); all ASDE-X systems, including wide area multilateration (WAM) and precision runway monitor (PRM) multilateration subsystems; and traffic collision avoidance system (TCAS)/Airborne Collision Avoidance System (ACAS).

The FAA has conducted multiple studies, and has concluded that over-interrogation of aircraft by legacy radars limits transponder availability and produces a large number of unwanted replies (e.g., FRUIT), which contributes significantly to congestion of this spectrum. The main objective of the research performed under this CRADA is to reduce transponder occupancy time in order to alleviate 1030/1090 MHz spectrum congestion.

The SELEX-FAA research team will establish specific research areas of interest. SELEX and FAA engineers then will work cooperatively to investigate performance enhancements and technology improvements to Mode-S transponders. The Department of Defense is also participating in this research agreement, as it operates several systems that use the 1030/1090 MHz frequency band.

The FAA's Technology Transfer Program oversees Cooperative Research and Development Agreements, and is based at the William J. Hughes Technical Center, near Atlantic City, N.J.

Innovative Welding Processes for Small to Medium Diameter Gas Transmission Pipelines

The Pipeline and Hazardous Materials Safety Administration (PHMSA) is sponsoring research and development projects focused on providing near-term solutions that will increase the safety, cleanliness, and reliability of the Nation's pipeline system.

A major challenge in high strength pipeline construction is producing small- to medium-diameter girth welds that have high quality and integrity. Manually shielded metal arc welding is currently used on these pipeline applications where the resulting weld deposit has marginal properties, high hydrogen content, and high defect propensity. The project team includes EWI, an internationally recognized leader in the development, evaluation and validation of pipeline welding, and materials joining technology; and Cranfield University, a leading provider of state-of-the-art automated pipeline welding technology.

The project developed and demonstrated Root Pass Welding Techniques, Improved Root Pass Techniques, and Process Control Systems for Pipeline Girth Welding with the CRC-Evans pulsed gas metal arc welding (GMAW-P) technology (P-450 & P-260).

FAA CRADA with RFID TagSource Reaches Major Milestone

The Federal Aviation Administration's (FAA) Technology Transfer Program, under a Cooperative Research and Development Agreement (CRADA) with RFID TagSource, of Camden, N.J., achieved a major milestone recently when partners conducted a series of international flight tests of their new technology.

Scientists affixed seven RFID TagSource High Memory AeroTag Radio Frequency Identification (RFID) tags to an engine on the FAA William J. Hughes Technical Center Federal Laboratory's Bombardier Global 5000 business jet. The unique RFID tags are designed and programmed to store maintenance history directly on the aircraft parts to which they are attached.

After many trans-Atlantic flights on the state-of-the-art Global 5000 test aircraft were conducted, these tags have continued to function accurately. The plan now is to leave the tags in place for continued flights, and to coordinate with the Technical Center's aircraft maintenance team to inspect the tags periodically when the Global 5000 is in the Technical Center hanger.

Leading airframe manufacturers, including Boeing and Airbus, are actively adopting and promoting this technology to their parts suppliers and airline customers as a means to ensure that aircraft parts are flight-certified and properly maintained. RFID TagSource is the only U.S. company and one of just four companies worldwide developing this technology. The work now under way on the Global 5000 is the most advanced testing of this technology ever conducted.

Flight testing of the RFID tags was the culmination of many ground-based laboratory tests, performed to test the tags for flight safety and durability for use on a commercial aircraft. The resources for these tests, made available under the CRADA, include the Technical Center's chemical laboratory, environmental chambers and fire test facilities. The unique access to these resources enabled the company to develop this technology in a manner that would not have been possible otherwise.

The benefits of adopting this new tag technology across the aerospace industry are well defined. The joint Technical Center/RFID TagSource CRADA is an excellent example of how the FAA collaborates with industry, using its top-notch facilities and resources, to deliver a unique, important capability, and ultimately support the mission of the FAA.

Technical and Economic Feasibility of Preventing SCC through Control of Oxygen

PHMSA is sponsoring research and development projects focused on providing near-term solutions that will increase the safety, cleanliness, and reliability of the Nation's pipeline system.

Stress corrosion cracking (SCC) has been observed in carbon steel tanks and piping in contact with fuel grade ethanol (FGE) in user terminals, storage tanks, and loading/unloading racks. Previous detailed laboratory studies demonstrated that, in ASTM D-4806 fuel grade ethanol, dissolved oxygen was the most important factor leading to SCC, followed in importance by pre-existing scale on steel, chloride, and methanol.

In a Roadmapping Workshop conducted in October 2007, methods to avoid oxygen contamination in ethanol and defining safe operating limits in terms of ethanol chemistry and oxygen concentration were identified as major gaps in the safe transportation of ethanol in pipelines.

The project validated the use of oxygen probes for measuring oxygen levels in pure ethanol and in fuel grade ethanol. The project improved Polestar oxygen probes so that they could directly measure the oxygen concentrations in ppm rather than in a partial pressure environment common with legacy systems.

Speeding Up FMCSA Technology Transfer and Deployment: New Mobile App Helps Consumers Assess Bus Safety

Recently, a team at the Volpe Center partnered with the Federal Motor Carrier Safety Administration (FMCSA) to develop and launch the SaferBus app—the first mobile application developed by DOT to enable users to view the safety records of bus companies.

SaferBus is available for free for all iOS devices. It operates under the motto "look before you book". The app gives users on-the-go access to important safety information about bus operators, providing consumers with the tools to make smart decisions prior to traveling with a particular company.

This app delivers streamlined access to FMCSA safety performance data, which includes privately operated motor coach, school bus, and tour bus companies. These records include a carrier's performance in important safety categories, including unsafe driving and driving under the influence of controlled substances or alcohol, from the agency's Compliance, Safety, Accountability (CSA) Safety Measurement System (SMS). The app also indicates that a company is "Not Allowed to Operate" if that company has been placed out of service or does not have the proper operating authority.

Volpe's team utilized non-proprietary software and subscription services, thus reducing the high licensing costs associated with the traditional software development model. FMCSA has asked Volpe to develop a SaferBus app for the Android platform as well, which would expand the tool's mobile reach beyond the Apple iPhone and iPad devices.

Volpe/NHTSA Development of Potential Specifications and Countermeasure Sounds for Quieter Vehicle to Ensure the Safety of Blind Pedestrians

Funded by the National Highway Traffic Safety Administration (NHTSA), Volpe Center prepared a report documenting research conducted to identify potential methods of developing a specification for vehicle sounds (audible countermeasures) for use in electric vehicles (EV), plug-in-hybrid electric vehicles (PHEV), or hybrid electric vehicles (HEV) operating in electric mode. This research initially studied the audibility safety issues of Quieter Cars, and focused on developing objective specifications for detectability using sound pressure levels (SPLs) and spectral profile characteristics. The purpose for the feasibility study of objectively specifying other aspects of sound quality was for predicting recognition.

Department of Veterans Affairs (VA)

The Department of Veterans Affairs (VA) operates, through the Veterans Health Administration (VHA), a substantial research program in connection with the research programs at many of the medical institutions with which VA is affiliated. As a result, many of our researchers also hold academic appointments with our affiliates. Some of our best and most beneficial inventions have come out of this setting, and VA wants to continue to promote this research environment and relationship, as it benefits our Veterans and the public generally.

Every year, VA researchers develop dozens of new health care-related technologies and other inventions. VA's Technology Transfer Program (TTP) translates the results of those discoveries into practice. TTP educates VA inventors on their rights and obligations; assists inventors on applying for Intellectual Property (IP) protections, evaluates invention disclosures; obtains patents; and helps commercialize new products to benefit Veterans and the American public.

VA's research program is different from other Federal technology transfer programs, because it is highly decentralized. The TTP office is located in Washington DC; however, the actual research is conducted at more than 100 VA Medical Centers (VAMC), all of which are Federal laboratories.

In addition, 124 VAMCs have formal affiliations with academic institutions and many VA researchers also have academic appointments. As a result, most VA inventions are jointly owned by VA and its academic affiliates, making technology transfer a collaborative effort between two entities. Affiliated academic institutions ask their employees and academic appointees to enter into agreements that give ownership of inventions to the academic affiliate. Because of this requirement, most VA inventions are jointly-owned by VA and its academic affiliates. To facilitate efficient technology transfer, TTP has executed Cooperative Technology Administration Agreements (CTAA) on VA's behalf with many academic affiliates. These CTAAs allow the affiliate to take the lead in the management of the co-owned inventions. At the same time, TTP manages the patent prosecution and marketing of inventions solely owned by VA, or inventions in which the academic affiliate declines to take the lead.

Critical components of any successful intellectual property program include patenting, marketing, and licensing new inventions or technologies to ensure timely production and introduction into the marketplace. CTAAs allow affiliates to take the lead in these activities for most jointly owned IP. Where VA is the sole owner of an invention or lead partner in a jointly owned invention, VA undertakes these activities. VA, through contracts, works with selected law firms to patent inventions. Marketing activities include advertising available technologies available for license on the TTP web site, and the use of professional services of an IP marketing contractor for technology assessments and marketing efforts.

TTP and VA Office of General Counsel (OGC) coordinate the negotiation of Cooperative Research and Development Agreements (CRADAs) and/or licenses with commercial entities. VA's OGC reviews and approves CRADAs and licenses prior to execution by the appropriate signing authority.

Successful patents licensed to manufacturers provide a royalty stream. As a result, inventors, their research laboratories, and the local VA facility share in licensing royalties. The American taxpayer will gain from this return on the research investment because resources will be reinvested in the original research laboratories to further additional biomedical advances.

Recently, VA TTP has developed a series of new initiatives to fulfill the goals of the President's Memorandum dated October 28, 2011, requiring all Federal departments and agencies to accelerate technology transfer and support private sector commercialization. Among these initiatives: increasing the number and quality of Invention Disclosures (ID) VA receives; streamlining the process of determining whether the Federal government is the owner of any invention; improving VA's current mechanisms for working with its affiliates; establishing a more systematic internal patent policy for VA; and improving VA's commercial licensing processes.

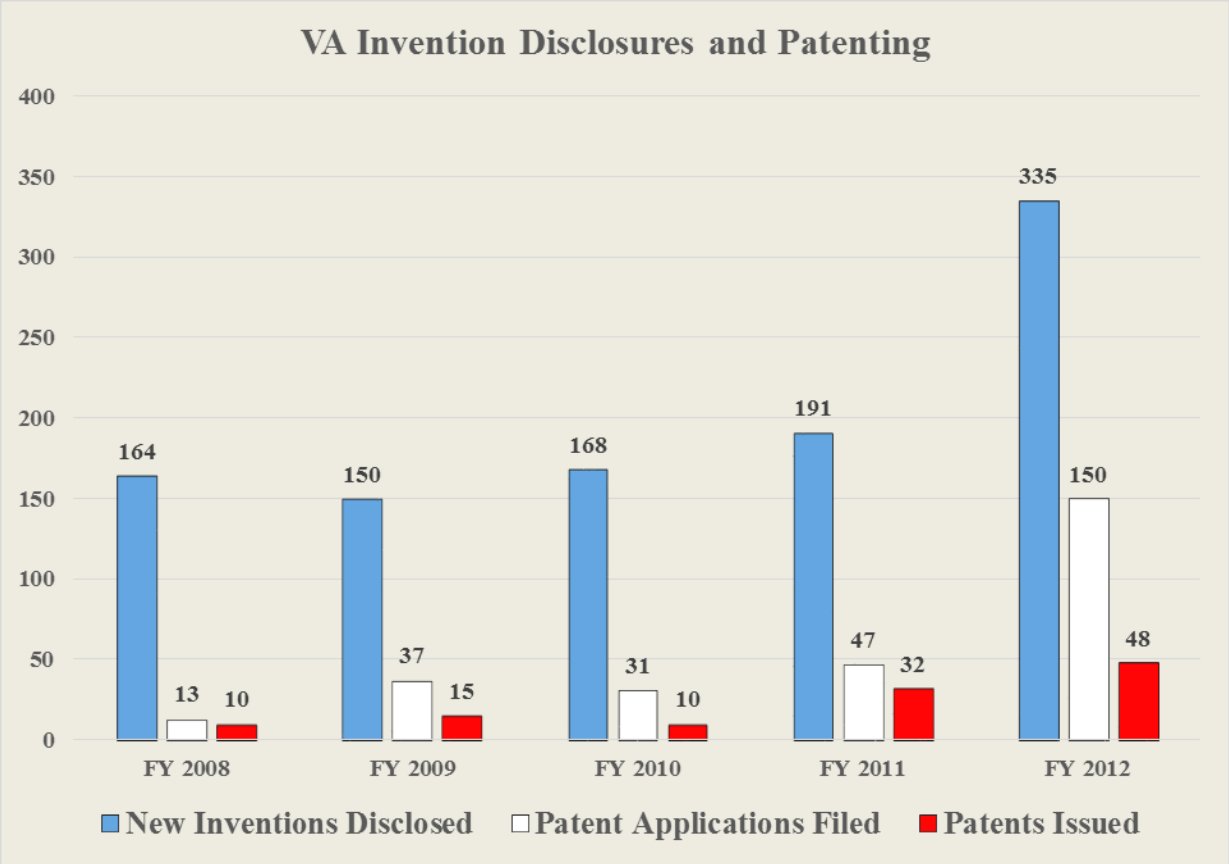
VA TTP is an important link in the process of ensuring Veterans receive access to the latest technologies developed by VA researchers. The program also helps VA and the American public to receive their fair share of royalties from patents and joint ventures with non-governmental agencies and private companies. VA is proud to support the President's goal of using technology transfer as a driver of successful innovation in the United States.

More information about VA technology transfer activities is available at

http://www.research.va.gov/programs/tech_transfer/default.cfm.

VA Invention Disclosures and Patenting

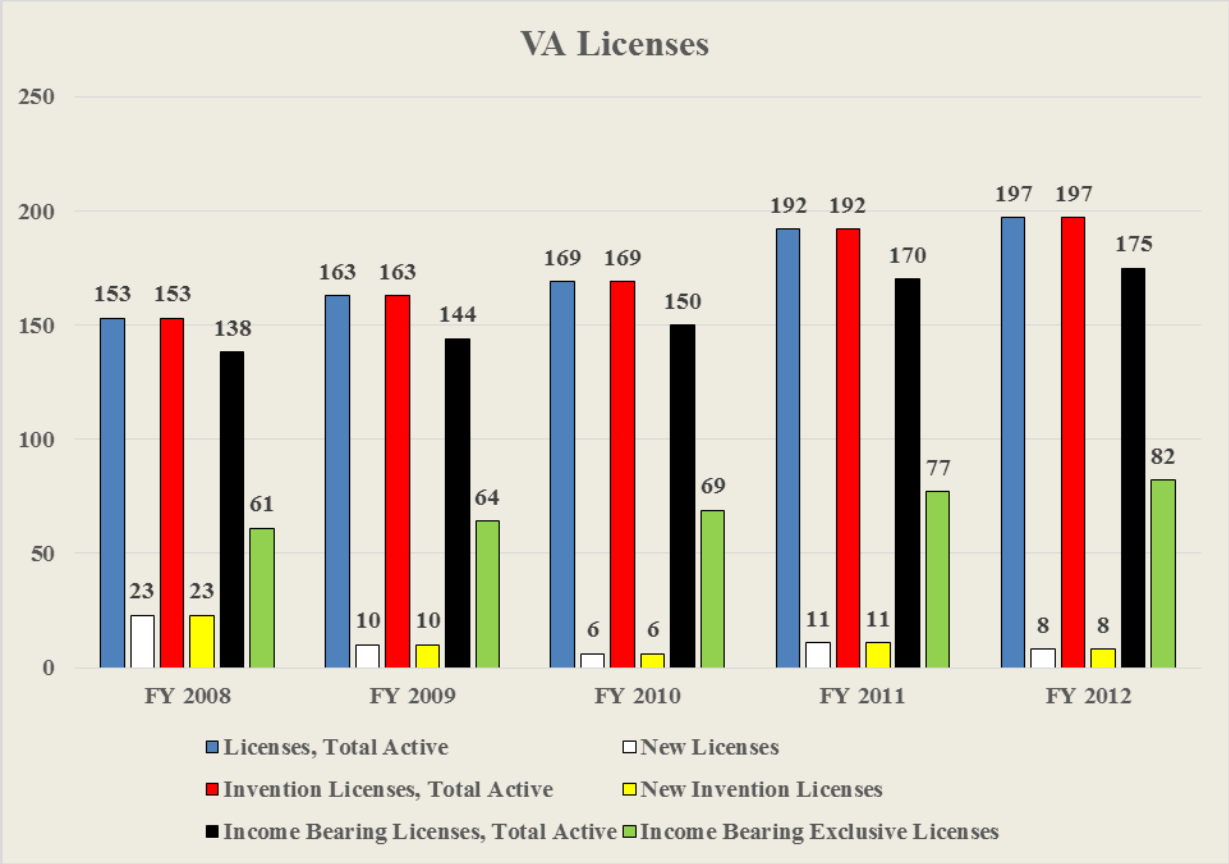
Between FY 2008 and FY 2012, invention disclosures increased by 104% to a total of 335 in FY 2012. The number of patent applications filed increased by 1,054% to 150, and the number of patents issued increased by 380% to 48 in FY 2012.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
New Inventions Disclosed	164	150	168	191	335
Patent Applications Filed	13	37	31	47	150
Patents Issued	10	15	10	32	48

VA Licenses

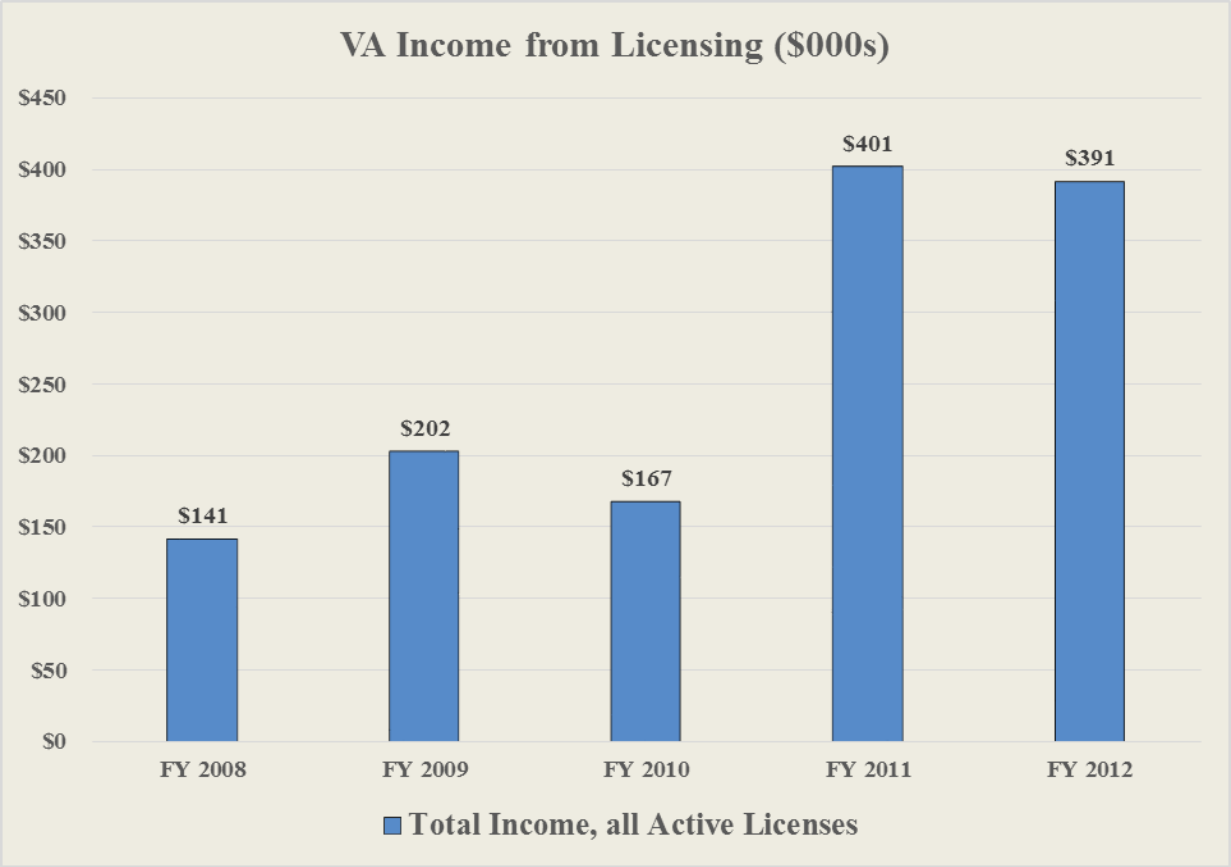
Between FY 2008 and FY 2012, the number of total active, invention licenses increased by 29% to a total of 197 in FY 2012. The number of income-bearing licenses increased by 27% to 175 and the number of income-bearing, exclusive licenses increased by 34% to 82 in FY 2012.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Licenses, Total Active	153	163	169	192	197
New Licenses	23	10	6	11	8
Invention Licenses, Total Active	153	163	169	192	197
New Invention Licenses	23	10	6	11	8
Income Bearing Licenses, Total Active	138	144	150	170	175
Income Bearing Exclusive Licenses	61	64	69	77	82

VA Income from Licensing

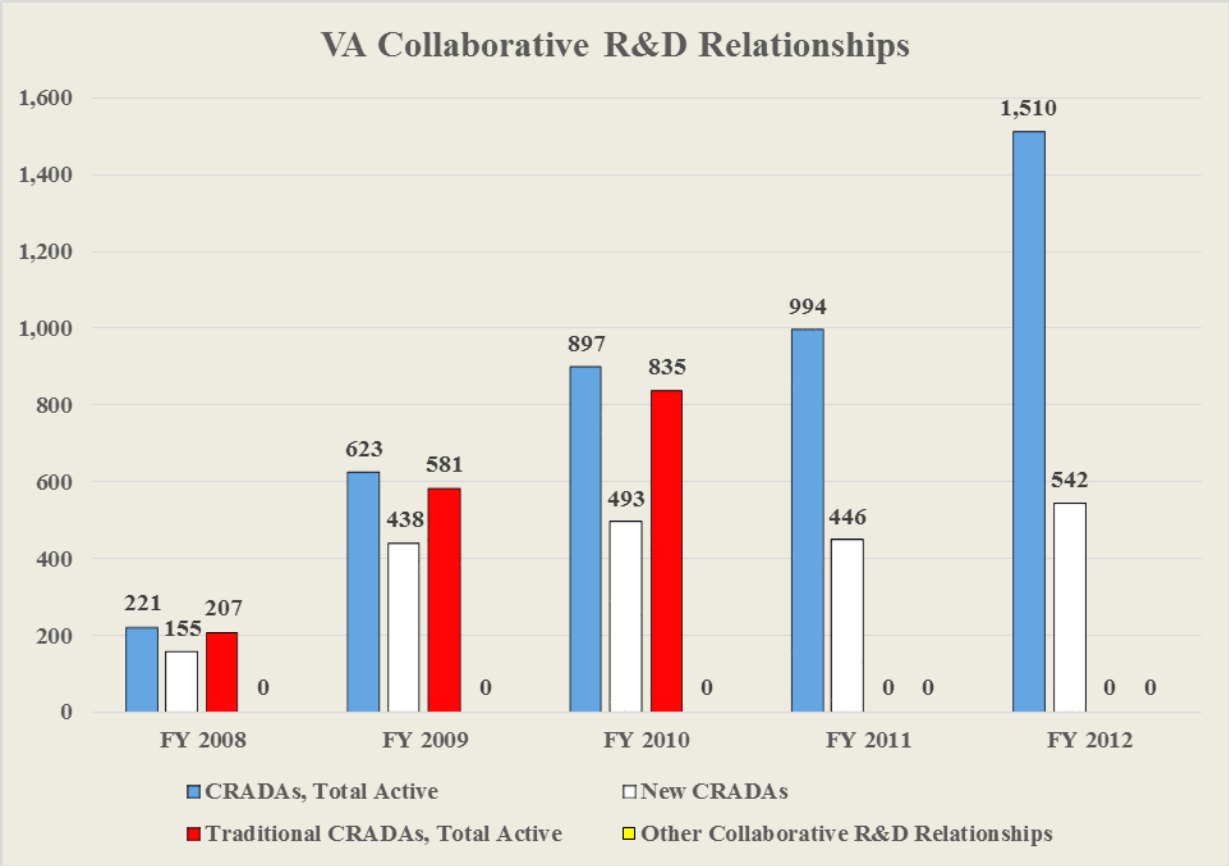
Between FY 2008 and FY 2012, income from all active, invention licenses increased by 177% to $391,000.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Total Income, all Active Licenses	$141	$202	$167	$401	$391
Invention Licenses	$141	$202	$167	$401	$391

VA Collaborative R&D Relationships

Between FY 2008 and FY 2012, the number of active CRADAs increased by 583% to a total of 1,510. No traditional CRADAs were reported in FY 2011 and FY 2012.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
CRADAs, Total Active	221	623	897	994	1,510
New CRADAs	155	438	493	446	542
Traditional CRADAs, Total Active	207	581	835	0	0
Other Collaborative R&D Relationships	0	0	0	0	0

Environmental Protection Agency (EPA)

EPA's Federal Technology Transfer Act (FTTA) Program was established to promote

collaboration between private sector and Federal researchers. EPA offers exceptional opportunities to develop and commercialize new technologies. Through the authority given to EPA by the Federal Technology Transfer Act of 1986 (Public Law 99-502), EPA facilitates the transfer of new technologies to the marketplace while protecting intellectual property rights of all parties.

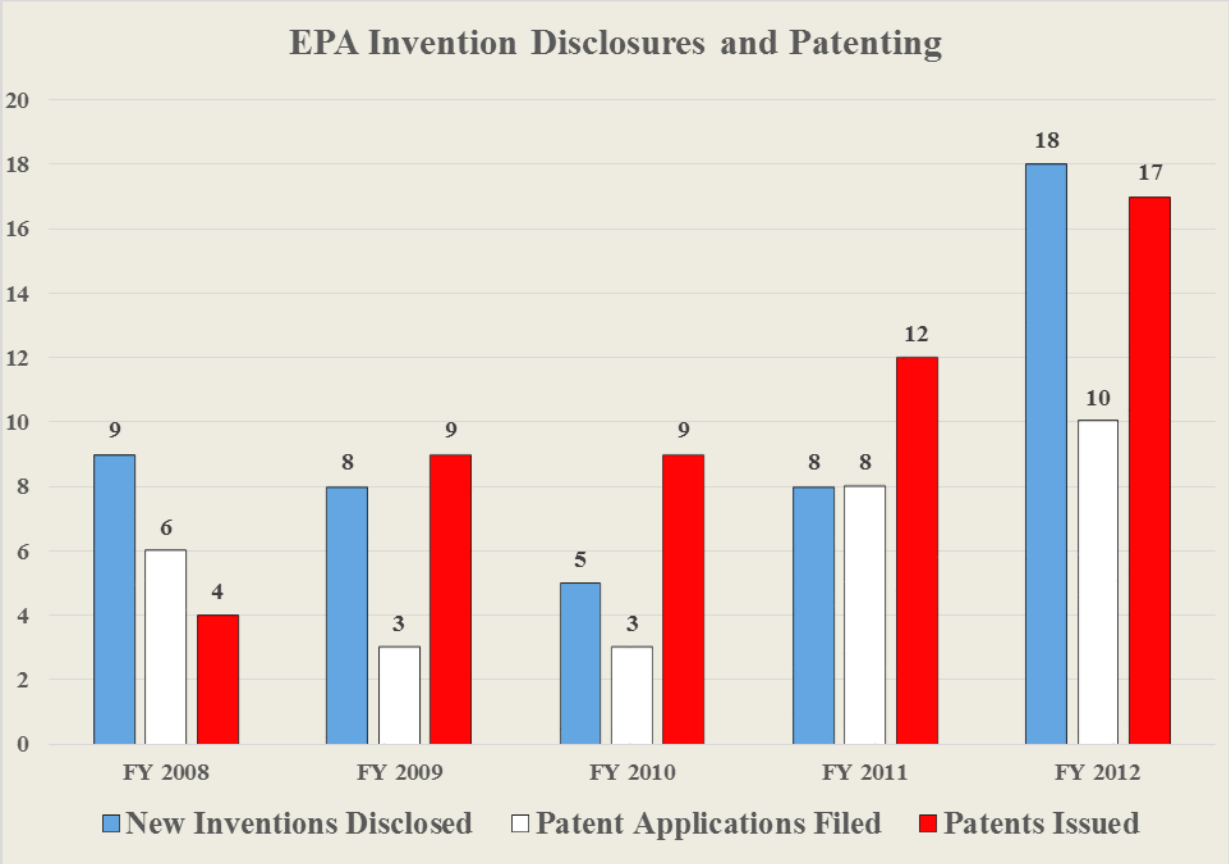
Partners in the FTTA Program have the benefit of collaborating with world-class EPA scientists involved in leading-edge research. Collaboration enhances the quality of research projects and helps move environmental technologies into the marketplace, resulting in better protection of human health and the environment.

More information about EPA technology transfer activities is available at

http://www.epa.gov/osp/ftta.htm.

EPA Invention Disclosures and Patenting

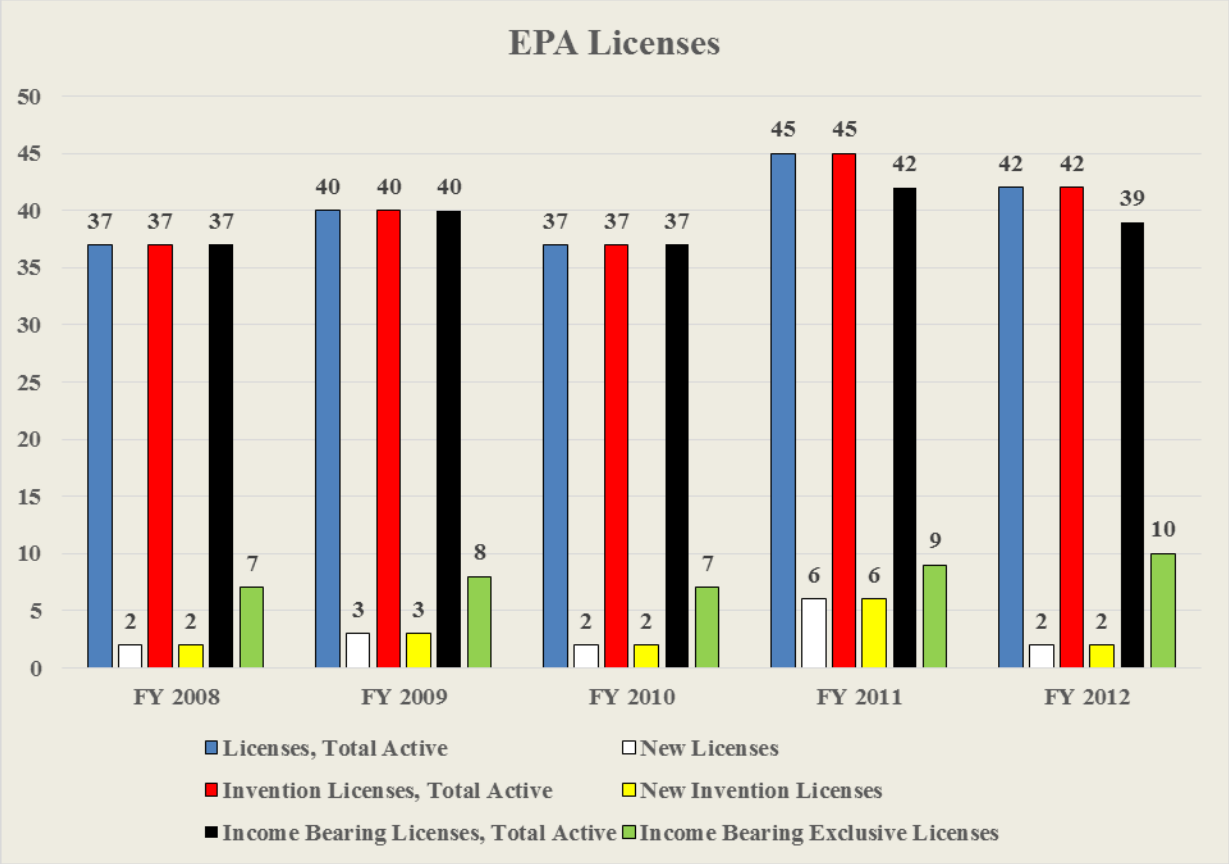
Between FY 2008 and FY 2012, new invention disclosures increased by 100% to 18, patent applications increased by 67% to 10 and the number of patents issued increased by 325% to 17.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
New Inventions Disclosed	9	8	5	8	18
Patent Applications Filed	6	3	3	8	10
Patents Issued	4	9	9	12	17

EPA Licenses

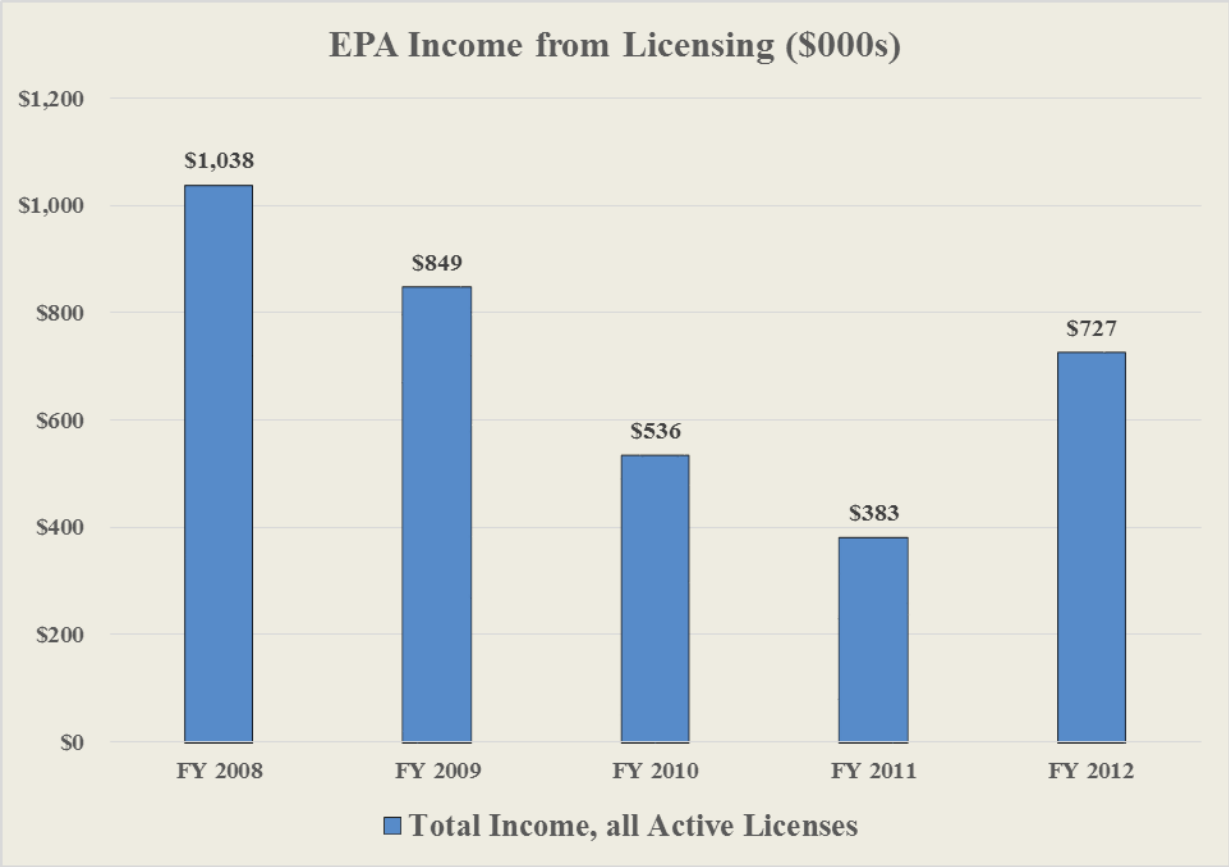
Between FY 2008 and FY 2012, active invention licenses increased by 14% to 42, income-bearing licenses increased by 5% to 39, and exclusive income-bearing licenses increased by 43% to 10.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Licenses, Total Active	37	40	37	45	42
New Licenses	2	3	2	6	2
Invention Licenses, Total Active	37	40	37	45	42
New Invention Licenses	2	3	2	6	2
Income Bearing Licenses, Total Active	37	40	37	42	39
Income Bearing Exclusive Licenses	7	8	7	9	10

EPA Income from Licensing

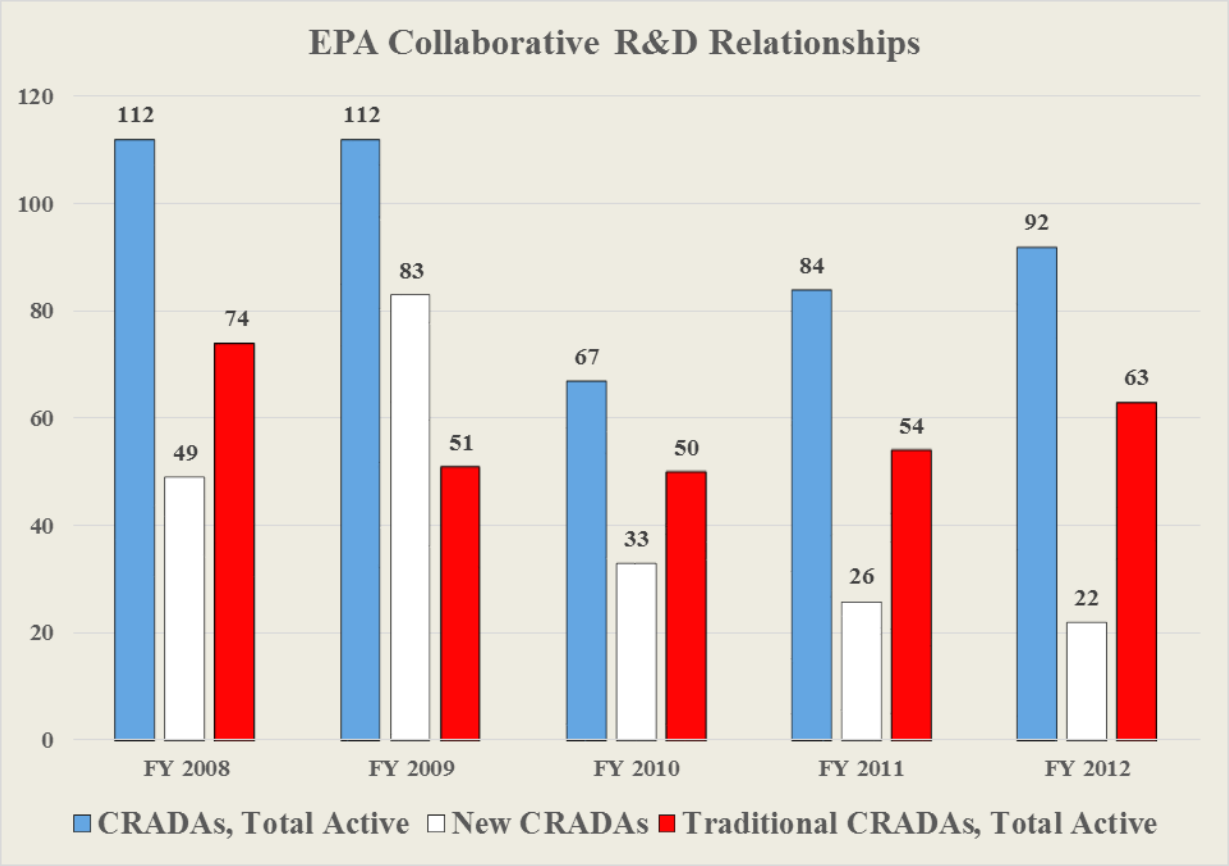
Between FY 2008 and FY 2012, income from all licensing decreased by 30% to a total of $727,000.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Total Income, all Active Licenses	$1,038	$849	$536	$383	$727
Invention Licenses	$1,038	$849	$536	$383	$727

EPA Collaborative R&D Relationships

Between FY 2008 and FY 2012, the number of active CRADAs decreased by 18% to a total of 92. The number of traditional CRADAs declined by 15% to 63.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
CRADAs, Total Active	112	112	67	84	92
New CRADAs	49	83	33	26	22
Traditional CRADAs, Total Active	74	51	50	54	63
Other Collaborative R&D Relationships	0	0	0	0	0

Downstream Success Stories for EPA

Collaborative Effort to Characterize Impacts of Wood-fired Technologies

The U.S. Environmental Protection Agency's (EPA's) Office of Research and Development (ORD) and the New York State Energy Research and Development Authority (NYSERDA) conducted a joint research project using a Cooperative Research and Development Agreement (CRADA) to characterize emissions, health impacts, and energy market penetration for a range of wood-fired, residential hydronic heater technologies.

Four types of residential wood-burning technologies were evaluated and characterized at the ORD combustion laboratories in Research Triangle Park, North Carolina for a variety of emissions under realistic, homeowner operation scenarios. The types of technologies evaluated included a common hydronic heater, a high-efficiency pellet heater, and a unit with thermal storage. Three fuel types, including red oak, white pine, and red oak with supplementary household refuse, were tested. Measurements included emissions of particulate matter, elemental carbon, carbon monoxide, polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and polychlorinated dibenzodioxins/dibenzofurans (PCDDs/Fs).

This work was complemented by an energy and market impacts analysis of hydronic heaters for the State of New York. Lastly, the health effects of hydronic heater emissions were evaluated with an exposure study for pulmonary and systemic biomarkers of injury and inflammation. The results of this study are anticipated to be of value to New York State in its efforts to develop a high-efficiency biomass heating market of technologies with acceptable emissions performance. It is also anticipated that these results will be of value to the U.S. EPA as it sets New Source Performance Standards for biomass-fired hydronic heaters.

A final report, executive summary, and two journal papers have been published on the results. Information on the effort has been presented at conferences in the northeastern United States.
Follow-up research is being conducted by New York State.

Collaboration to Develop Methods to Remediate Environmental Contaminants in Soil and Water Using Greener Nanomaterials

Since 2008, EPA's National Risk Management Research Laboratory (NRMRL) and VeruTEK Technologies have been collaborating under a CRADA to further develop nanoparticle-based methods for remediating and destroying organic and inorganic environmental contaminants in the subsurface and in water. These methods help to address contamination at industrial sites. The project combines EPA expertise and more environmentally-friendly technologies using surfactant-enhanced in situ chemical oxidation methods with VeruTEK's in situ reduction methods. The benefits of this project are development and testing of new technologies that provide "greener" remediation of pollutants in soil and water.

Thus far in this project, EPA and VeruTEK have co-authored three peer-reviewed journal articles, which describe usage of greener synthesis of nanoparticles (such as Nanoscale Zero-Valent Iron) for use in environmental remediation, including single-step synthesis of iron nanoparticles using tea. The collaborators have also had six patents issued on technologies, such as polymer-coated nanoparticle activation of oxidants for remediation, and green synthesis of nanometals using plant extracts.

VeruTEK is in the process of commercializing the Green nano-scale Zero-Valent Iron (GnZVI) product developed under the CRADA. Zero-Valent Iron is an effective reducing agent, used in environmental

remediation and wastewater treatment to eliminate contaminants such as chlorinated solvents, a wide range of pesticides, and arsenic. ZVI is often implemented as part of permeable reactive barrier (PRB), or is injected into the subsurface with an emulsifier or capping agent.

The GnZVI product, developed from natural plant extracts such as sorghum and green tea, has demonstrated strong performance in studies conducted by academics and third party environmental testing laboratories both as a novel activator for chemical oxidation techniques and as a reductant. In addition, the product successfully reduced TCE contamination in a field pilot at a U.S. Superfund site. As a result of the strong trial results, the GnZVI product has attracted commercial interest from a number of sources.

National Aeronautics and Space Administration (NASA)

NASA has a long history of being a leader in technology development and transferring its space and aeronautics research to the public. The benefits of NASA research are all around us: knowledge provided by weather and navigational spacecraft, efficiency improvements in both ground and air transportation, super computers, solar- and wind-generated energy, the cameras found in many of today's cell phones, improved biomedical applications including advanced medical imaging and even more nutritious infant formula, as well as the protective gear that keeps our military, firefighters, and police safe.

NASA technologies have made us healthier and safer, introduced space-age efficiencies to our manufacturing processes, made transportation safer, and paved the way for cleaner and greener technologies. Meanwhile, these same technologies have launched companies, even industries, saved lives, and created jobs.

To facilitate and manage the transfer of NASA technology, the agency has a technology transfer office at each of its ten field centers, and the overall activity is managed out of NASA Headquarters in Washington, DC. Each of the field centers is responsible for maintenance of its own technology portfolio and technology transfer activities, from new technology reporting through reporting of successes.

In the coming years, as NASA renews its technology-development emphasis, the agency's technology transfer program will work to meet this influx of new inventions, and the public should experience a commensurate increase in the benefits of NASA's research and development activities.

NASA's new technology investment strategy will drive the next wave of innovation, enabling missions to be performed in new ways and creating missions never possible before. NASA's innovations will provide countless opportunities for advances in science, engineering, transportation, public safety, computer science, industrial productivity, consumer goods, health, and medicine while supporting the U.S. global leadership in innovation.

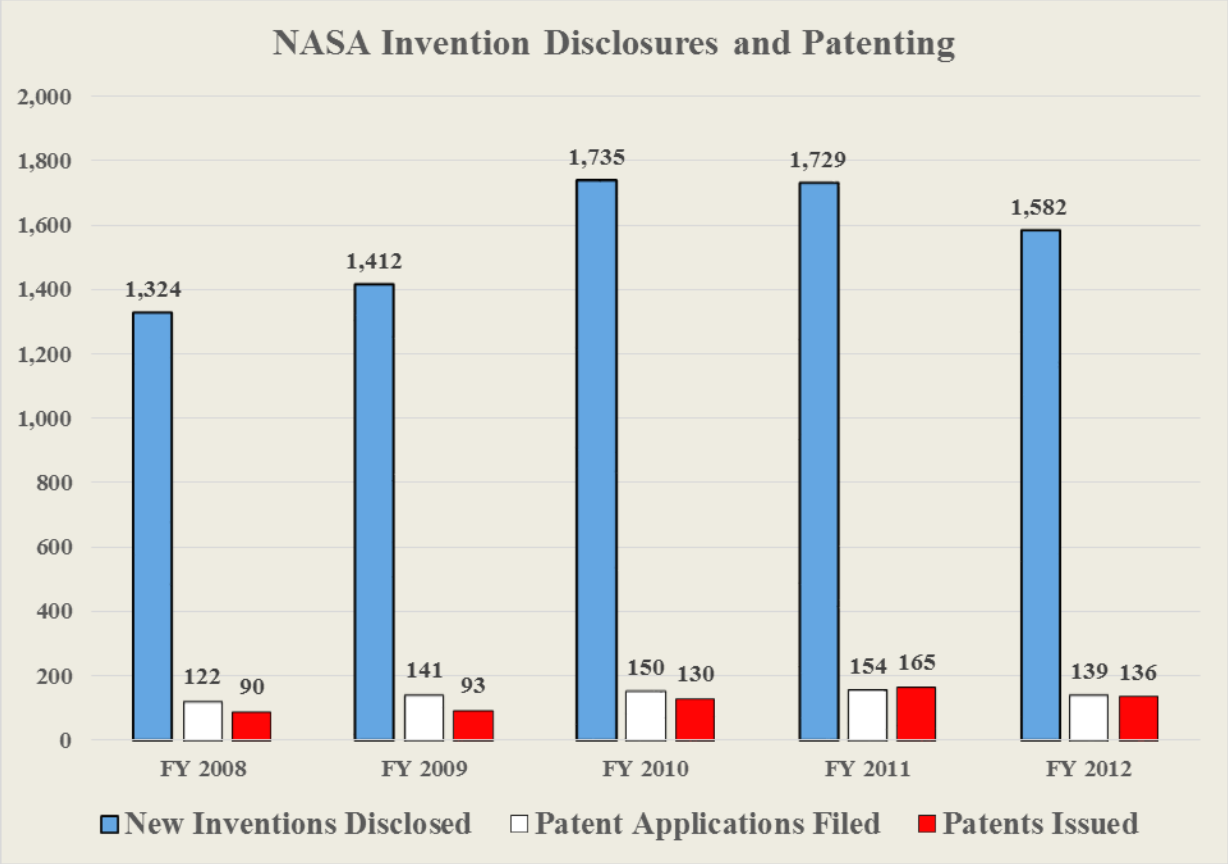
NASA will implement a robust effort that matures technologies so that they are used by NASA missions as well as other government agencies and private sectors. NASA will identify and patent those technologies that are promising. Industry will license existing patents. Other technologies may be distributed via other collaborative research partnerships. Those that are successfully transferred to the commercial market will be highlighted in the annual Spinoff report.

More information about NASA technology transfer activities is available at

http://www.nasa.gov/offices/oct/home/index.html.

NASA Invention Disclosures and Patenting

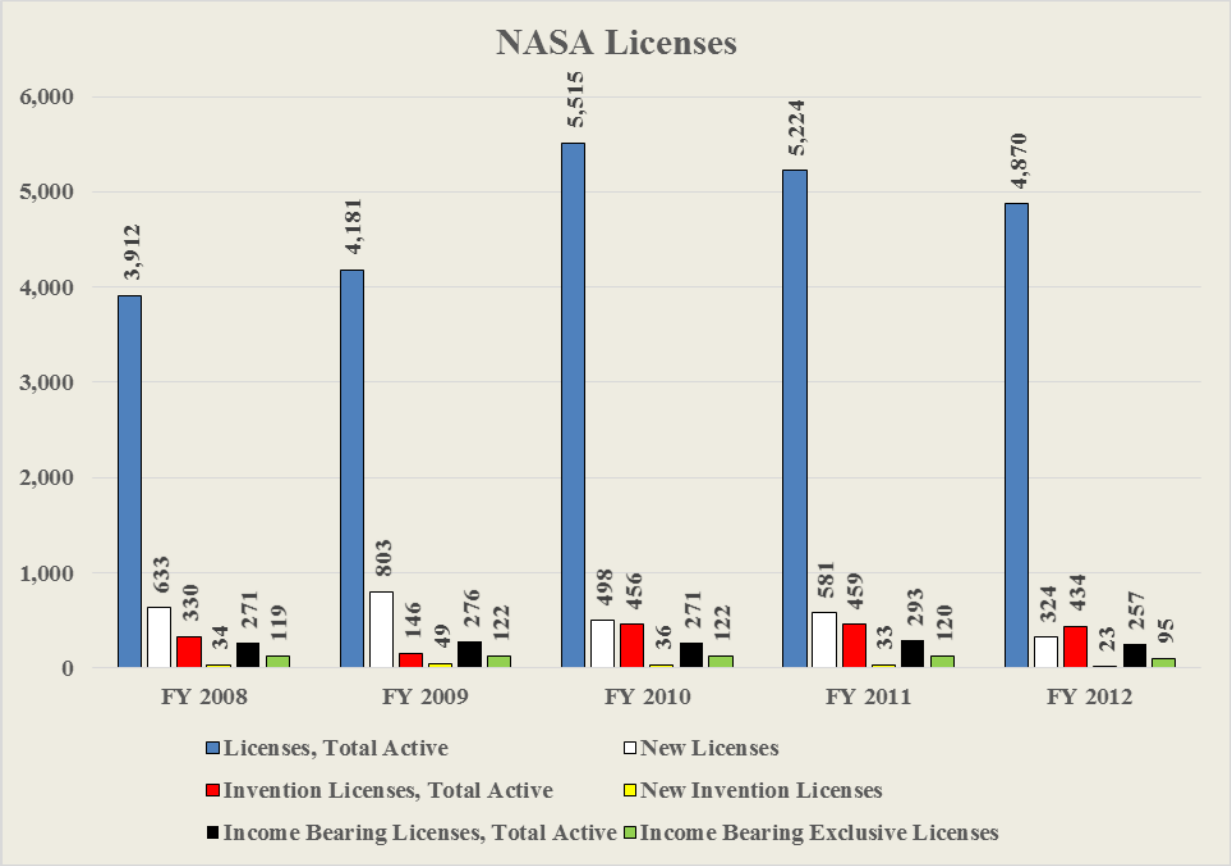
Between FY 2008 and FY 2012, the number of new invention disclosures increased by 19% to a total of 1,582 in FY 2012. The number of patent applications filed increased by 14% to 139, and the number of patents issued increased by 51% to 136 in FY 2012.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
New Inventions Disclosed	1,324	1,412	1,735	1,729	1,582
Patent Applications Filed	122	141	150	154	139
Patents Issued	90	93	130	165	136

NASA Licenses

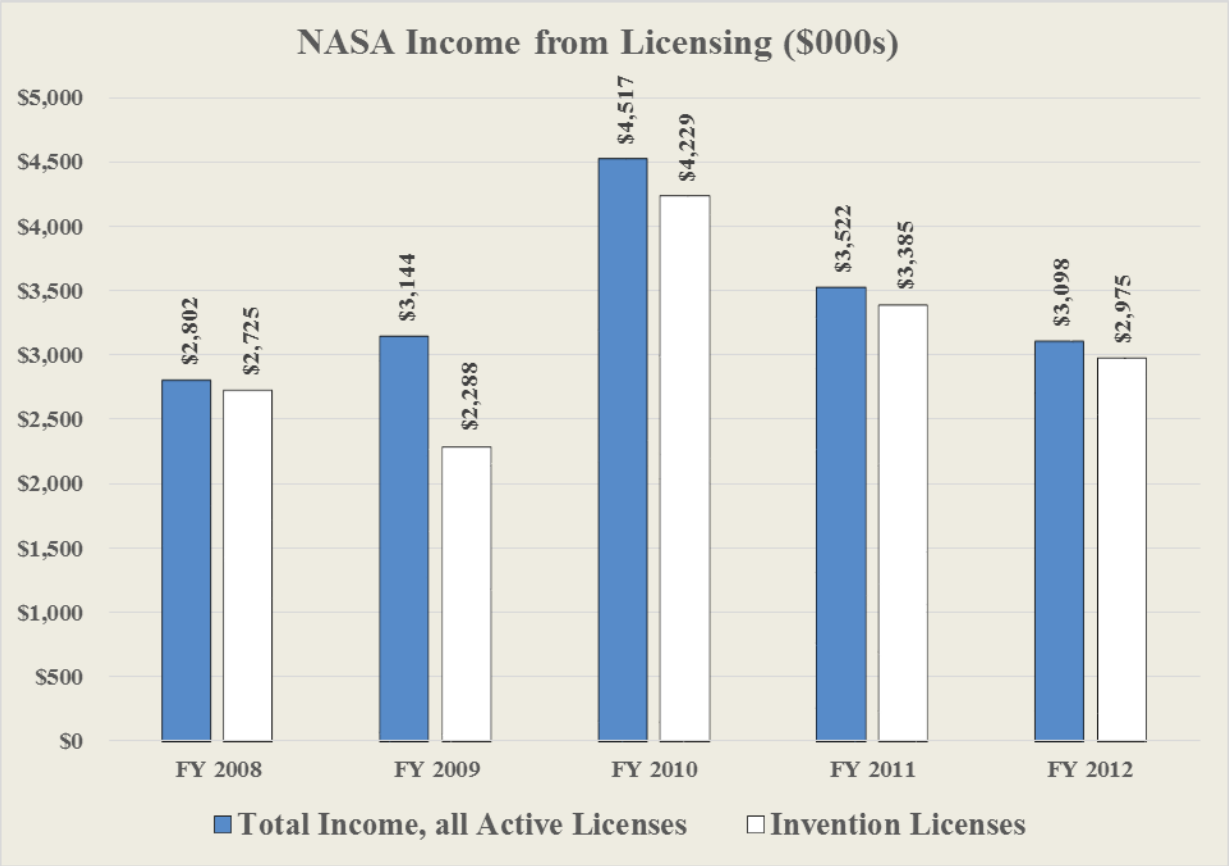
Between FY 2008 and FY 2012, the number of total active licenses increased by 24% to a total of 4,870 in FY 2012. The number of invention licenses increased by 32% to 434. The number of income-bearing licenses declined by 5% to 257, while the number of income-bearing, exclusive licenses declined by 20% to a total of 95.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Licenses, Total Active	3,912	4,181	5,515	5,224	4,870
New Licenses	633	803	498	581	324
Invention Licenses, Total Active	330	146	456	459	434
New Invention Licenses	34	49	36	33	23
Income Bearing Licenses, Total Active	271	276	271	293	257
Income Bearing Exclusive Licenses	119	122	122	120	95

NASA Income from Licensing

Between FY 2008 and FY 2012, income from all licensing increased by 11% to a total of $3.10 million. Income from invention licenses increased by 9% to $2.98 million.

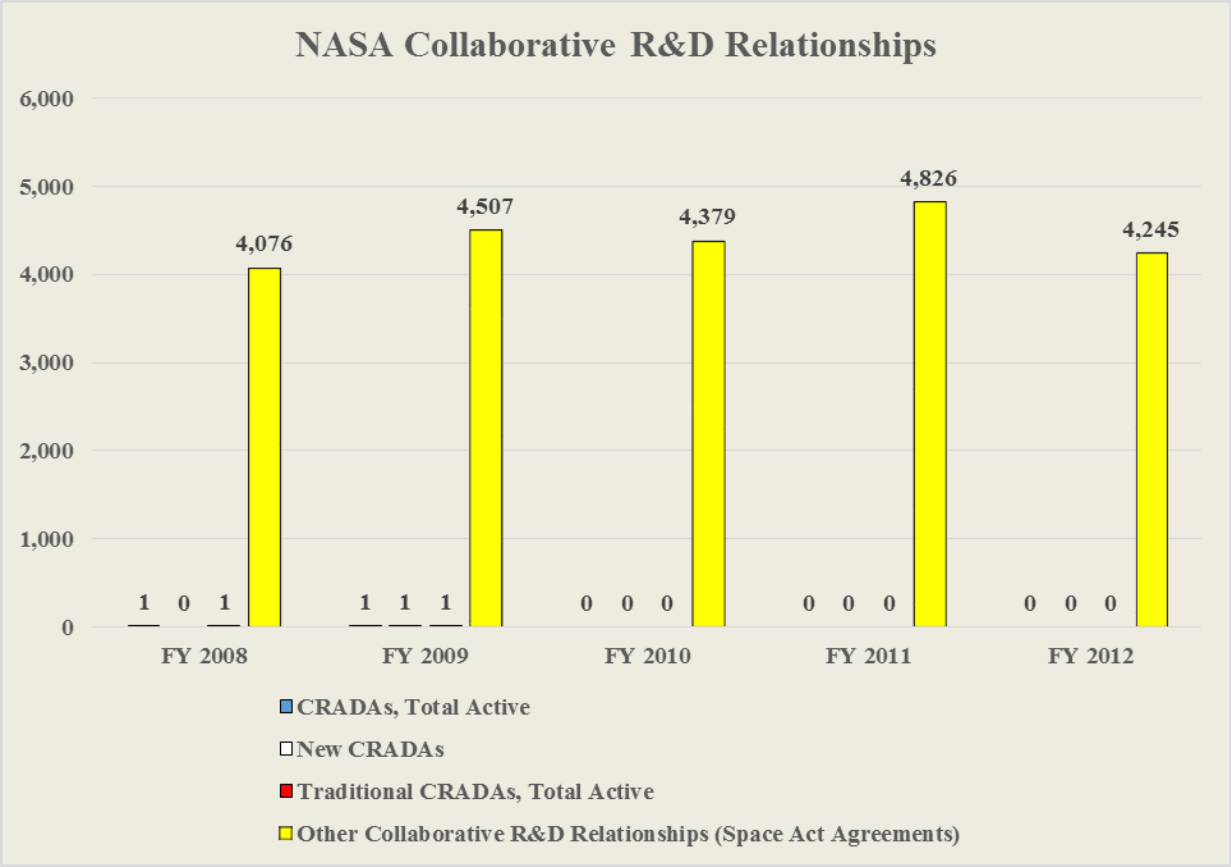


	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Total Income, all Active Licenses	$2,802	$3,144	$4,517	$3,522	$3,098
Invention Licenses	$2,725	$2,288	$4,229	$3,385	$2,975

NASA Collaborative R&D Relationships

A significant portion of NASA's technology transfer is implemented through partnerships with other government agencies, industry, academia, and other entities through non-CRADA mechanisms such as Space Act Agreements (SAA).[21]

Between FY 2008 and FY 2012, the number of active collaborative relationships (SAAs) has increased by 4% to a total of 4,245.



	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
CRADAs, Total Active	1	1	0	0	0
New CRADAs	0	1	0	0	0
Traditional CRADAs, Total Active	1	1	0	0	0
Other Collaborative R&D Relationships (Space Act Agreements)	4,076	4,507	4,379	4,826	4,245

[21] See http://www.nasa.gov/open/plan/space-act.html

Downstream Success Stories for NASA

Thermal Components Boost Performance of HVAC Systems

A Rockledge, Florida-based company, Mainstream Engineering Corporation, works with NASA to develop advanced thermal control technology for spacecraft. Most recently, Mainstream developed new products, based on SBIR work with Johnson Space Center, that improve air conditioner performance and filtration—a boon for allergy and asthma sufferers.

Control Algorithms Charge Batteries Faster

Advanced Power Electronics Corporation of Orlando, Florida, partnered with Glenn Research Center through the SBIR program to develop an advanced power converter for space systems. The company incorporated control algorithms created through the partnership into a solar charger that charges batteries 30 percent faster than comparative devices.

Rugged Analyzers Measure Greenhouse Gasses, Airborne Pollutants

Los Gatos Research Inc., of Mountain View, California, partnered with Ames Research Center to develop instrumentation for detecting signs of life in deep sea and deep space environments. This led the company to commercialize a range of highly accurate and sensitive analyzers for detecting pollutants and greenhouse gasses. Los Gatos plans to grow from 30 to nearly 50 full-time employees by the end of 2011.

Custom Machines Advance Composite Manufacturing

Through the SBIR program, Accudyne Systems Inc. of Newark, Delaware, developed a device for creating thermoplastic composite structures without the use of an expensive autoclave. The partnership yielded technology for the company's commercial, custom-built composite manufacturing machines, helping advance composite part fabrication.

Integrated Design Tools Save Time, Money

Thanks in part to a SBIR award with Langley Research Center, Phoenix Integration Inc., based in Blacksburg, Virginia, modified and advanced software for process integration and design automation. For NASA, the tool has resulted in lower project costs and reductions in design time; clients of Phoenix Integration are experiencing the same rewards.

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Chapter 3 Conclusion

Technology transfer is an active and essential mission of Federal research and development laboratories. By leveraging our Nation's innovative nature and investing in science and technology, we strengthen our economy and American competitiveness in world markets. This report details the results of technology partnering activities of Federal agencies.

Statistical data provided in this report indicates that there has been an increase in invention disclosures and patenting activities over the five-year span from 2008 through 2012. Most significant was a 44% increase in the number of patents issued. Licensing activity was fairly constant over this period with a 16% decline in the overall number of income-bearing licenses and a 6% increase in the number of income-bearing exclusive licenses. Licensing income was reported to have decreased by 3%, but this number will be revised upward in future reports to account for anomalies caused by litigation issues.[22] Finally, the number of Federal collaborative R&D relationships has increased significantly due primarily to increases in reporting of non-CRADA arrangements. CRADAs (both traditional and non-traditional) increased by 27%, with traditional CRADAs increasing by 16%. Reports of other types of collaborative activity (guest scientists and engineers, user facilities agreements, etc.) resulted in increases of 70% in the reported values.

While these numbers show a robust and wide-ranging set of technology transfer activities, they do not tell the whole story. Federal laboratories transfer many technologies through a variety of mechanisms not reflected in this report. As a result of the September, 2011 Presidential Memorandum on technology transfer, significant efforts are now underway to greatly expand and improve the metrics Federal agencies use to monitor technology transfer activities and to provide more effective methods to assess the resulting economic impacts. Future editions of this report will include these changes.

The success stories presented in this report provides examples of how society benefits from technology transfer activities across the Federal laboratories. As technology advances and the needs of the economy change, Federal laboratories will continue to play a vital role in keeping America in the forefront of innovation. Federal research and development supports the Nation's economic growth and international competitiveness by successfully transferring and facilitating commercialization of federally created technologies.

[22] See footnote 13.

Appendix A

Federal Invention Disclosure and Patenting

Agency	Metric	FY 2008	FY 2009	FY 2010	FY 2011	FY2012
DHS	New inventions disclosed	10	32	7	38	40
	Patent applications filed	-	2	2	12	10
	Patents issued	1	2	1	-	-
DOC	New inventions disclosed	40	41	34	26	52
	Patent applications filed	21	20	20	17	21
	Patents issued	3	7	11	15	12
DOD	New inventions disclosed	1,018	831	698	929	1,037
	Patent applications filed	590	690	436	844	888
	Patents issued	462	404	304	523	667
DOE	New inventions disclosed	1,460	1,439	1,616	1,820	1,661
	Patent applications filed	904	775	965	686	780
	Patents issued	370	363	480	460	483
DOI	New inventions disclosed	7	4	5	5	10
	Patent applications filed	7	8	7	2	3
	Patents issued	1	4	5	1	3
DOT	New inventions disclosed	3	3	1	2	2
	Patent applications filed	2	2	2	2	1
	Patents issued	4	1	2	-	-

Federal Invention Disclosures and Patenting (continued)

Agency	Metric	FY 2008	FY 2009	FY 2010	FY 2011	FY2012
EPA	New inventions disclosed	9	8	5	8	18
	Patent applications filed	6	3	3	8	10
	Patents issued	4	9	9	12	17
HHS	New inventions disclosed	437	389	363	402	252
	Patent applications filed	164	156	113	266	222
	Patents issued	278	397	153	320	372
NASA	New inventions disclosed	1,324	1,412	1,735	1,729	1,582
	Patent applications filed	122	141	150	154	139
	Patents issued	90	93	130	165	136
USDA	New inventions disclosed	100	143	149	142	160
	Patent applications filed	123	123	112	121	122
	Patents issued	30	24	46	49	70
VA	New inventions disclosed	164	150	168	191	335
	Patent applications filed	13	37	31	47	150
	Patents issued	10	15	10	32	48

Total	Metric	FY 2008	FY 2009	FY 2010	FY 2011	FY2012
	New inventions disclosed	4,572	4,452	4,781	5,292	5,149
	Patent applications filed	1,952	1,957	1,841	2,159	2,346
	Patents issued	1,253	1,319	1,151	1,577	1,808

Federal Licenses

Agency	Metric	FY 2008	FY 2009	FY 2010	FY 2011	FY2012
DHS	All licenses, number total active	18	63	458	495	532
	Invention licenses, total active	-	-	-	-	-
	All income bearing licenses, total active	-	-	-	-	-
	Income bearing exclusive licenses	-	-	-	-	-
DOC	All licenses, number total active	29	40	46	40	41
	Invention licenses, total active	29	40	46	40	41
	All income bearing licenses, total active	25	27	28	25	24
	Income bearing exclusive licenses	14	15	17	15	15
DOD	All licenses, number total active	365	432	397	633	520
	Invention licenses, total active	351	386	341	431	432
	All income bearing licenses, total active	210	227	134	214	356
	Income bearing exclusive licenses	70	78	67	51	120
DOE	All licenses, number total active	6,196	5,742	6,228	5,310	5,328
	Invention licenses, total active	1,448	1,452	1,453	1,432	1,428
	All income bearing licenses, total active	4,397	3,339	3,493	3,510	3,340
	Income bearing exclusive licenses	372	411	462	315	344
DOI	All licenses, number total active	19	21	28	25	26
	Invention licenses, total active	18	18	23	23	24
	All income bearing licenses, total active	16	18	19	22	22
	Income bearing exclusive licenses	5	4	5	3	12
DOT	All licenses, number total active	5	2	3	3	3
	Invention licenses, total active	5	3	3	3	3
	All income bearing licenses, total active	4	3	3	3	3
	Income bearing exclusive licenses	1	3	3	2	2

Federal Licenses (continued)

Agency	Metric	FY 2008	FY 2009	FY 2010	FY 2011	FY2012
EPA	All licenses, number total active	37	40	37	45	42
	Invention licenses, total active	37	40	37	45	42
	All income bearing licenses, total active	37	40	37	42	39
	Income bearing exclusive licenses	7	8	7	9	10
HHS	All licenses, number total active	1,675	1,584	1,941	1,613	1,465
	Invention licenses, total active	1,376	1,304	1,240	414	1,090
	All income bearing licenses, total active	1,057	899	838	1,023	856
	Income bearing exclusive licenses	149	111	113	131	135
NASA	All licenses, number total active	3,912	4,181	5,515	5,224	4,870
	Invention licenses, total active	330	146	456	459	434
	All income bearing licenses, total active	271	276	271	293	257
	Income bearing exclusive licenses	119	122	122	120	95
USDA	All licenses, number total active	328	330	344	358	384
	Invention licenses, total active	304	302	313	322	341
	All income bearing licenses, total active	326	327	340	354	379
	Income bearing exclusive licenses	235	234	248	257	277
VA	All licenses, number total active	153	163	169	192	197
	Invention licenses, total active	153	163	169	192	197
	All income bearing licenses, total active	138	144	150	170	175
	Income bearing exclusive licenses	61	64	69	77	82

Total	Metric	2008	2009	2010	2011	2012
	All licenses, number total active	12,732	12,596	15,163	13,935	13,405
	Invention licenses, total active	4,046	3,851	4,078	3,358	4,029
	All income bearing licenses, total active	6,481	5,300	5,313	5,656	5,451
	Income bearing exclusive licenses	1,033	1,050	1,113	980	1,092

Federal Income from Licensing ($000)

Agency	Metric	FY 2008	FY 2009	FY 2010	FY 2011	FY2012
DHS	Total income, all licenses active	$0	$0	$0	$0	$0
	Invention licenses	$0	$0	$0	$0	$0
DOC	Total income, all licenses active	$293	$336	$237	$277	$248
	Invention licenses	$293	$336	$237	$277	$248
DOD	Total income, all licenses active	$16,057	$16,439	$13,424	$15,682	$7,055
	Invention licenses	$16,048	$16,165	$13,026	$15,364	$6,552
DOE	Total income, all licenses active	$49,318	$43,570	$40,644	$44,728	$40,849
	Invention licenses	$43,108	$40,262	$37,066	$40,600	$36,103
DOI	Total income, all licenses active	$79	$89	$80	$93	$78
	Invention licenses	$79	$89	$80	$93	$78
DOT	Total income, all licenses active	$18	$44	$17	$15	$7
	Invention licenses	$18	$44	$17	$15	$7
EPA	Total income, all licenses active	$1,038	$849	$536	$383	$727
	Invention licenses	$1,038	$849	$536	$383	$727
HHS	Total income, all licenses active	$97,609	$85,059	$80,923	$98,453	$110,576
	Invention licenses	$94,712	$83,041	$79,805	$82,842	$108,308
NASA	Total income, all licenses active	$2,802	$3,144	$4,517	$3,522	$3,098
	Invention licenses	$2,725	$2,288	$4,229	$3,385	$2,975
USDA	Total income, all licenses active	$3,953	$5,376	$3,641	$3,989	$3,806
	Invention licenses	$3,884	$5,318	$3,566	$3,855	$3,671
VA	Total income, all licenses active	$141	$202	$167	$401	$391
	Invention licenses	$141	$202	$167	$401	$391

Total	Metric	FY 2008	FY 2009	FY 2010	FY 2011	FY2012
	Total income, all active licenses	$171,309	$155,108	$144,186	$167,542	$166,835
	Invention licenses	$162,046	$148,594	$138,729	$147,214	$159,059

Federal Collaborative R&D Relationships

Agency	Metric	FY 2008	FY 2009	FY 2010	FY 2011	FY2012
DHS	CRADAs, total active in the FY	23	23	36	62	94
	Traditional CRADAs, total active in the FY	21	22	32	55	89
	Other collaborative R&D relationships	3	5	3	11	11
DOC	CRADAs, total active in the FY	2,390	2397	2254	2,280	2,934
	Traditional CRADAs, total active in the FY	131	101	101	133	156
	Other collaborative R&D relationships	2,816	2,828	2,897	2,899	2,782
DOD	CRADAs, total active in the FY	2,596	2,870	3,248	2,554	2,400
	Traditional CRADAs, total active in the FY	1,993	2,247	2,516	1,685	1,328
	Other collaborative R&D relationships	3	1	287	988	0
DOE	CRADAs, total active in the FY	711	744	697	720	742
	Traditional CRADAs, total active in the FY	711	744	697	720	742
	Other collaborative R&D relationships	0	0	0	0	0
DOI	CRADAs, total active in the FY	170	248	436	351	379
	Traditional CRADAs, total active in the FY	33	36	29	24	28
	Other collaborative R&D relationships	0	0	0	209	283
DOT	CRADAs, total active in the FY	23	22	22	25	27
	Traditional CRADAs, total active in the FY	23	22	22	25	27
	Other collaborative R&D relationships	0	2	2	5	5

Federal Collaborative R&D Relationships (continued)

Agency	Metric	FY 2008	FY 2009	FY 2010	FY 2011	FY2012
EPA	CRADAs, total active in the FY	112	112	67	84	92
	Traditional CRADAs, total active in the FY	74	51	50	54	63
	Other collaborative R&D relationships	0	0	0	0	0
HHS	CRADAs, total active in the FY	453	457	447	430	377
	Traditional CRADAs, total active in the FY	295	284	300	284	245
	Other collaborative R&D relationships	0	0	0	0	0
NASA	CRADAs, total active in the FY	1	1	0	0	0
	Traditional CRADAs, total active in the FY	1	1	0	0	0
	Other collaborative R&D relationships	4,076	4,507	4,379	4,826	4,245
USDA	CRADAs, total active in the FY	254	259	288	300	257
	Traditional CRADAs, total active in the FY	223	207	218	186	180
	Other collaborative R&D relationships	5,821	10,306	11,570	13,458	14,351
VA	CRADAs, total active in the FY	221	623	897	994	1510
	Traditional CRADAs, total active in the FY	207	581	835	994	1430
	Other collaborative R&D relationships	0	0	0	0	

Total	Metric	2008	2009	2010	2011	2012
	CRADAs, total active in the FY	6,954	7,756	8,392	7,800	8,812
	Traditional CRADAs, total active in the FY	3,712	4,296	4,800	4,160	4,288
	Other collaborative R&D relationships	12,719	17,649	19,138	22,396	21,677

Appendix B

Technology Area Classifications

Mapping of International Patent Classifications to Technology Area[23]

Aerospace & Defense: parts and components that pertain to aircraft and spacecraft as well as defense mechanisms. This includes engines, jet propulsion, gas turbines, and fuel control related to airplanes, helicopters, spacecraft and lighter-than-air vehicles. Defense includes weapons, ammunition, explosives, warship or submarine weaponry as well as protective gear, armed vehicles and land defense devices. Note: Engines and turbines included here are primarily for aircraft, but some for locomotives and ships will appear as well.

Agriculture: equipment, methods and materials used for farming and livestock. This includes equipment for harvesting, mowing, soil working, plowing, thrashing and fertilizing. It also includes pesticides, fertilizers, growth regulators, soil additives, plant biotechnology, seed genetics and horticulture techniques. Animal husbandry includes housing, breeding, taming, grooming, feeding devices, pasteurizing equipment and shearing tools.

Audio-Visual Electronics: high-tech consumer electronics and their underlying technologies and distribution. This includes photography equipment (cameras, photo processing, printing (includes some lithographic apparatuses), televisions, stereos, speakers, video games, musical instruments as well as pictorial and broadcast communication.

Automation & Control: items that controls, monitor and automate machinery and devices. This includes sensors, switches, and alarms, regulating mechanisms, micro fluidics, safety devices and industrial robotics. This provides for remote control, traffic control, rail signaling and switching and pipe-line system control. Also includes are automatic door/window mechanisms widely used in the automotive industry.

Biotechnology: pertains to living organisms (or parts of living organism) used primarily for medicinal purposes and diagnostics, as well as genetic engineering and biotechnology research equipment. This includes vaccines, pharmaceuticals, nutraceuticals, herbal remedies, peptides, sugars, nucleic acids, micro-organisms, enzymes, genetic engineering, measuring and testing techniques, research and laboratory equipment and combinatorial chemistry.

Chemical Engineering & Environmental Processes: select processes and techniques used in chemical industrial processes, recycling, treating materials to make them safer or for safe disposal. This includes separation and filtration techniques, mixing, cryogenics, waste and water treatments, soil reclamation and solid waste disposal. Included in separation techniques are processes related to catalysts, including catalytic converters for engine exhaust gases (but not muffler/exhaust systems).

[23]

Chemicals: organic or inorganic compositions and processes involving dyes, pigments, coating, cleaning, polishing, glue, gelatin, catalysts, fatty acids, petrochemicals, natural resins, and electrolytic processes.

Civil Engineering: involves the design and structural integrity of natural and man-made structures. This includes bridges, railways, roads, highways, platforms and pads, foundations, dams, other water structures, scaffolding, supports, building systems and structures, including interior architectural aspects (partitions, ceilings, roof constructions, etc.).

Computer Systems: related to the hardware and basic software necessary to operate a computer. This includes static and dynamic information storage, memory, data transfer to peripherals, power control, input/output, CPUs, disk drives, and peripherals such as keyboards and mice. Included in information storage is magnetic recording which may also relate to audio/visual storage devices.

Construction & Building Components: primarily construction materials and components of buildings, but also contains valves and mechanisms used for hydraulic systems. This includes plumbing and sewage supplies, bathroom fixtures and other fixtures such as doors, windows and their hardware, roofs, gutters, fluid handling (includes fire-fighting equipment), dispensers and sprayers (some hand pumps and atomizers in here) as well as concrete shaping and mixing. It also includes ladders, winches, pulleys and hardware (nails, screws, nuts, bolts, etc.) as well as locks and locking mechanisms (widespread industry use which includes vehicle door locks and handcuffs).

Electrical Components & Equipment: materials and equipment necessary to run electricity, and the mechanisms that connects them. This includes connectors (many of the type made by electronic connector companies), plugs, outlets, surge protectors, switches, fuses, relays, cables (includes those used for telecommunications, i.e. coaxial cable), lines, wires, insulators, magnets, inductors, transducers, spark gaps (not plugs used for vehicles), printed circuits and shielding devices (includes EMI).

Electronic Components & Devices: components related to high-tech electronic equipment and devices that perform functions. This includes display technologies, capacitors, resistors, actuators, piezoelectric devices, card readers and connectors, as well as components for navigational items, spectrometers, micro-electromechanical systems (MEMS), data collectors (i.e. bar code scanners, ID card readers) and registers.

Food & Tobacco: food, beverage and tobacco products, processes and manufacturing equipment. This includes treatments and products for dairy, sweets and oils including fragrances & flavorings, additives, preservatives, dough/flour treatments as well as beverages such as coffee, tea, alcohol and beer. It also includes meat processing and butchering, milking machines, food processing/chemistry, sugar processing, beer brewing, protein manipulation (e.g. enzymes), animal feed and tobacco processing and products.

Household Appliances & Lighting: electric appliances used in the home as well as lighting fixtures. This includes dishwashers, ovens, ranges, microwaves, refrigerators, washers, dryers, sewing machines, vacuums, space heaters, small kitchen appliances, fireplaces and grills. Lighting includes fixtures as well as their electric parts, bulbs, sources, forms and use including some aspects for vehicle lighting and light sources for backlights or LEDs.

Industrial Machinery & Tools: machinery and their parts used for industrial means as well as hand and power tools. This includes equipment for welding, soldering, cutting, abrading, crushing, printing (not printers), presses, sandblasting, lubricating, perforating and punching. It also includes rotary piston machines, electric machinery, general purpose engines, compressors, pumps, boilers, furnaces, water heaters, heating, ventilation, air conditioning (includes window units), humidifiers (some stand-alone units) and refrigeration, jacks, forklifts as well as hand (hammers, pliers, crowbars, woodworking, etc.) and power tools along with workbenches and storage. Parts include bearings, gears, transmission, belts, seals and pistons as well as parts that go into motors used in a wide variety of products (i.e. spindle motors, disk drive motors).

Industrial Manufacturing: processes and techniques used to manufacture products. This includes packaging and handling machinery such as sheet feeders, conveyers, cranes, bottle and jar closures as well as processes for coating, drying, fluid dispensing, applying or handling, heat exchangers, heating and melting equipment, electrostatic spraying, pattern making, etching, labeling and bookbinding. This also includes postal/document handling or sorting as well as storage and transport containers.

Information Processing: data or information processing, computational models, business methods. This includes image analysis, data capture and collectors, speech/audio processing, database structures, error detection/correction, security, analog to digital conversion, data transfer sequencing as well as computer software.

Materials Manufacturing: processing and treatment of materials along with their related machinery, as well as layered products. This includes metalworking, metal casting, metal rolling, foundry molding, photomechanical processes, chemical and mechanical treatments, textile cleaning and dying, clothes manufacturing, electrolytic processes, paper/cardboard processes, coating processes as well as layered products comprising different materials or are of certain forms.

Materials: glass, minerals, pulp, paper, fibers, textiles, metals, and composites thereof. This includes plastics, polymers, rubber, cement, ceramics, stone, micro and nano-structures, liquid crystal materials, anti-oxidants and adhesives as well as materials that are electro chromic, photosensitive, luminescent, thermoelectric and radioactive in nature.

Measurement Techniques & Instrumentation: techniques and use of instrumentation which measures, tests, inspects or analyzes a wide variety of materials or processes. This includes measuring electric variables, distances, volume, flow, velocity, speed, force, stress, torque, temperatures, weight, length, thickness, and mechanical vibrations through tapes, levels, global-positioning devices, radar, scales, thermometers and flow meters, among other specialized devices. This also includes horology, meteorology, geophysics (e.g. earthquake detection/measurement), analyzing chemical or physical processes and associated laboratory equipment (e.g. centrifuges, beakers, test tubes, etc.), investigating or analyzing materials (includes optical means for inspection widely used in the semiconductor industry) and scanning-probe microscopy.

Medical Electronics: electronics used for therapy, diagnostic and imaging purposes on humans. This includes x-rays, radiation imaging, ultrasonic imaging and materials analysis.

Medical Equipment: materials, devices, instruments and equipment used to diagnose or treat human or animal medical ailments. This includes equipment related to veterinary care, dental, ophthalmic and hearing treatments as well as drug delivery means, surgical instruments, implantable devices, wound care, contraceptives, prostheses; as well as catheters, sterilization techniques, diagnostic equipment (non-electronic), scopes and stethoscopes.

Motor Vehicles & Parts: parts and components that pertain to motor vehicles. This includes the vehicle body, seats, tires, wheels, engines, exhaust system, heating and ventilation. Parts include spark plugs, shocks, starters, ignition, fuel injection, mechanical controls, steering, clutches, brakes, gearings, air bags and other safety mechanisms, suspension, springs, shocks, dampeners, lubricators, windshield wipers along with other vehicle fittings and parts.

Networking: technology related to transmission of data over a network. This is primarily related to digital transmission via transport protocols, modems and routers, as well as the control, starting, synchronization or stabilization of electronic oscillation or pulses (phase-locked loops). Note: there are many aspects of the internet protocol suite that spans codes that are not primarily for companies involved with networking applications and equipment and therefore are not included.

Office Equipment: primarily high-tech equipment and their special functions that used in an office. This includes technologies related to copiers, printers, fax machines, imaging functions, as well as the ink and recording materials relating to them. It also includes general office supplies such as staplers, paper clips, pens, pencils, whiteboards, erasers, etc.

Oil & Gas, Mining: machinery, processes and production of oil, gas and mining techniques. This includes boreholes, hydrocarbon production and recovery, lubricants, drilling compositions, fuel compositions and processing, petroleum products, coke ovens, distillation, mining machinery, ventilation and safety.

Optics: optical elements, materials and systems. This includes light guides, lenses, waveguides, optical fibers, electro-chromic materials, microscopes, telescopes, optical modulation, MEMS, masers, lasers, holography, optical measuring instruments and optical arrangements for controlling displays.

Other Transport: parts and components that pertain to locomotives, railways, boats, ships, hovercrafts, bicycles, snowmobiles, animal drawn and hand propelled vehicles (strollers, carriages, carts). This includes engines, propulsion systems, steering, wheels, brakes, frames, suspension, couplings, docking and launching. It also contains elevators and escalators.

Other: processes, methods, machinery and materials that do not fit any one category. This area currently comprises cleaning machines (semiconductor cleaning and dishwashers are prevalent), igniters, burners, gas handling and storage, designs and patterns, theatrical devices, safes, strong-rooms, sound producing/protecting (not speakers) mechanical vibration producing machinery, electric shock devices, engravers, stampers, street sweepers, snow making/removal and laminating methods. Note that this category will also cover any IPC coding errors (typos) as well as newly formed IPC codes.

Personal Care & Household Goods: items used by people or for basic household needs. This includes cosmetics, skin care, grooming, toiletries, air fresheners, baby items (bottles, pacifiers, diapers, etc.), cleaning implements and kitchenware (not appliances). Also included are furniture, apparel (includes protective gear and professional garments such as surgical gowns), umbrellas, canes, luggage, purses, and window and door coverings, greeting cards, picture frames/displays and identification tags.

Pharmaceuticals: preparation and compounds of synthetic therapeutic drugs. This includes over-the-counter drugs, targeted medicinals and steroids.

Power Generation & Distribution: generation of small or large-scale power from both traditional and alternative energy sources and means for distribution. This includes batteries, fuel cells, generators, motors (motor control), fusion reactors as well as combustion, power conversion and distribution. Alternative energy includes solar, wind, wave, tidal, hydroelectricity and geothermal means as well as nuclear.

Recreation & Sports Equipment: items that relate to sports, games, toys and amusement. This includes rackets, balls, clubs, and training implements for sports such as golf, tennis, basketball, baseball, billiards, bowling, skiing, boxing, skating, archery, fishing and gymnastics. It also includes equipment used for camping, horseback riding, parks and amusement rides, tracks and rinks, as well as games (not video), toys, and miscellaneous carriers for sports or other equipment.

Semiconductors: semiconductor materials, manufacturing, design and processes. This includes silicon wafer manufacturing, solid-state devices and solar cells, as well as processes such as chemical-vapor deposition (CVD), coating, etching and polishing as well as computer-aided design.

Telecommunications: transmission of voice/data over land lines or wireless and the equipment necessary to deliver. This includes antennas, receivers, equipment arrangements, modulation, waveguides, resonators, multiplexing, and impedance networks.

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