Federal Laboratory Technology Transfer

Fiscal Year 2008

Summary Report to the President and the Congress

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FOREWORD

The Department of Commerce is pleased to submit this fiscal year 2008 Technology Transfer Summary Report to the President and the Congress in accordance with 15 USC Sec 3710(g)(2) for an annual summary report on the implementation of technology transfer authorities established by the Technology Transfer Commercialization Act of 2000 (P.L. 106-404) and similar legislation. This report highlights the achievements of Federal technology transfer and partnering programs of Federal research and development agencies.

Technology transfer promotes the commercialization of government funded research and development resulting from Federal laboratories' internal research and from collaborative research programs, conducted jointly with other public and private sector organizations. Effective technology transfer is an important part of Federal laboratories' missions. Today, Federal laboratories reach out to industry, academic institutions, non-profit foundations, state and local governments, and international institutions through external collaborations and partnerships, thereby leveraging the Federal investment in research and development. The Federal investment in research and development serves as an engine to keep the United States a leader in technology advancement and innovation and stimulates economic growth. This report provides a summary of the results of Federal technology transfer in fiscal year 2008.

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CHAPTER 1

Overview of Federal Technology Transfer

Federal laboratories continue to actively partner with numerous and diverse non-federal organizations in industry, academia, the non-profit sector, and state and local governments. Through these partnerships Federal agencies are better able to transform the results of their research into economic and social value. Agencies utilize a wide variety of authorities and agreements to evaluate, protect, transfer, and monitor the utilization and commercialization of technologies developed in whole or in part by Federal laboratories. While focusing on important national interests, Federal laboratories continue to develop many new technologies, products, and applications that solve many of our greatest challenges. By making these discoveries accessible to private, academic and other government entities, Federal research and development (R&D) provides expertise and resources resulting in viable products that give the United States a competitive edge in today's global market and improve the quality of life for all Americans.

This report summarizes information from individual reports prepared by each Federal agency conducting R&D within its laboratories and provides an overview of activities across agencies. This summary report has been organized and prepared by the Department of Commerce (DOC) National Institute of Standards and Technology (NIST). An electronic version of this report is available on the internet at: http://patapsco.nist.gov/ts/220/external/index.htm.

Scope

This report summarizes the technology transfer achievements 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)

All of these agencies have established programs for transferring the technology and intellectual property arising from their laboratory science and technology endeavors.

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 technology transfer offices. Collaboration amongst Federal laboratories, industry, academia, non-profit organizations, and state and local governments play an important role in the efficient and timely development of innovative technologies, new products and new and promising research opportunities. Efficient Federal technology transfer activities ensure that tax payer investments in leading edge and fundamental research and development significantly benefit the domestic economy through the transfer of rights to develop, refine, use and market new technologies for the benefit of the public. Since Federal research activities are often driven by a specific need, many economically viable advancements might otherwise be overlooked, shelved or otherwise go unused without dedicated efforts by Federal technology transfer offices to promote the dissemination and utilization of the results of such research activities. Effective technology transfer promotes real economic growth through the development of new products, medical treatments, services, and other innovations that reach the market, and through the creation of the jobs resulting from the manufacturing and marketing these new goods. In addition to strengthening the domestic and regional economies, successful partnerships with non-Federal entities provide additional benefits including:

- Stimulating the flow of ideas between the government and other research sectors
- Creating new businesses, especially small businesses
- Attracting and retaining talented scientific personnel within the Federal laboratories
- Providing support to the mission of each agency
- Accelerating the development and reducing the costs of products and services to reach the marketplace
- Supporting further research by generating licensing revenue
- Rewarding innovative accomplishments of Federal inventors through royalty sharing
- 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 offices typically rely on the following principal mechanisms to facilitate the transfer of Federally-developed technologies:

▪ Cooperative Research and Development

Relationships for cooperative research and development between Federal laboratories and non-Federal collaborators are widely viewed as effective and economical means of technology transfer and joint research. Cooperative research and development efforts confer a mutually advantageous leveraging of Federal agency and collaborator resources and technical capabilities, as well as provide avenues for both the partner and the Federal laboratory to gain new competences and develop new skills.

One frequently used mechanism for establishing these joint relationships is the Cooperative Research and Development Agreement (CRADA). CRADAs are agreements between a Federal laboratory and one or more collaborators to work together on a R&D project with a defined scope of work. CRADAs were created by the Congress, in part, to encourage Federal laboratories to participate in R&D partnerships for the purpose of developing and advancing promising new technologies toward commercialization. Most agencies have other authorities which also facilitate cooperative R&D. Some of those authorities are unique, such as NASA's Space Act authority, and some are more generally available to other Agencies, such as various "work for others" authorities.

▪ Intellectual Property Management

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, general publications and patents obtained are often cited as metrics of the active management of intellectual assets and technical know-how by Federal agencies.

Licensing

Licensing is one of the primary mechanisms to create incentives for industry to further develop and commercialize leading edge technologies. Successful development and commercialization benefits the economy generally and contributes to competitiveness and economic growth. Without the ability to grant licenses to develop and commercialize government-owned technologies and inventions, many innovations would languish on laboratory shelves and would not be further developed into products or services. The terms and conditions under which Federal intellectual property is licensed varies, based on many factors including the state of readiness for the market place, the financial resources needed to further develop the technology for consumer use, fields of use, projected market impact and other factors.

Other Commercialization Mechanisms

Other than licensing, there are a wide variety of technology transfer methods used by Federal agencies. Different mechanisms are used when licensing may not be necessary to efficiently or effectively transfer the technology. Some of the mechanisms used by Federal laboratories are tailored to support the specific focus, needs and mission of a particular Federal laboratory and/or a particular technology. Some of these other technology transfer mechanisms include:

- Presentations at conferences, workshops, and inquiries
- Utilization of guest researchers and facilities users
- Outreach to trade and technical media
- Technical publications and other reports
- Development of Standard Reference Materials
- Development of Standard Reference Data

- Development of documentary standards
- Material transfer licenses
- Calibration services
- Collaborative research agreements (e.g., Memorandum of Understanding (MOU), Clinical Trial Agreements)

CHAPTER 2

Performance in Fiscal Year 2008

Strengthening Performance Metrics

Each Federal research and development agency is required to prepare and submit an annual report of its technology transfer activities as described in 15 USC 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 to promote U.S. competitiveness. In addition, specific data is provided to demonstrate the level of basic technology transfer, including:

- Number of patents filed
- Number of patents granted
- Number of licenses and details regarding the license
- Earned royalty income and other royalty statistical information
- Disposition of royalty income
- Number of licenses terminated for cause
- Discussion of other relevant parameters unique to the agency

The tables below present a brief cross-agency summary of the utilization of the above technology transfer tools. It is evident from this data that technology transfer activities and practices are widely used across the agencies. However, measuring the overall impact of technology transfer continues to be challenging. It remains far easier to assemble statistics on technology transfer activities than to quantify actual downstream benefits and effectiveness of the transfers because of the many variables and factors involved in commercializing nascent technologies. For example, knowledge gained from initial research may not make an immediate impact on the public, but may open new avenues for discoveries that lead to future products, medical treatments, and services.

To improve and develop better measures of the effectiveness of Federal technology transfer, the Federal Interagency Working Group on Technology Transfer (IWGTT) meets regularly and is attended by agency representatives and technology transfer experts from across the Federal government. The IWGTT serves as a broad forum to identify and discuss emerging concerns and technology transfer practices and trends through the process of dialogue, interagency comparisons and experience sharing. Through the IWGTT, Federal agencies jointly discuss and review new and better means to improve both quantitative and qualitative measurements of technology transfer activities and means to improve dissemination of Federally-developed technologies. In 2009, the Government Accountability Office (GAO) conducted a study of the effectiveness of technology transfer at DOE laboratories. The IWGTT is examining the GAO's findings and recommendations, including those for technology transfer performance measures. The IWGTT will draw upon the GAO recommendations to look for ways to improve metrics and to enhance technology transfer efforts.

Anecdotal evidence and success stories demonstrating the broad range of successful outcomes of technology transfer such as life-saving treatments, increased security or

awareness about dangers and hazards, and new business start-ups provide a few examples of outcomes. Chapter 3 of this report provides a small sampling of the numerous positive impacts and outcomes of Federal technology transfer activities.

The following tables summarize the technology transfer activities compiled from each agency's report, for a five year period from fiscal year 2004 to through fiscal year 2008. The total figures from the eleven agencies indicate that licenses, income bearing licenses, income from licenses, and earned royalty income generally trended upward over this period. However, invention disclosures, patent applications filed, and patents issued remained steady over the same period. The number of active CRADAs declined slightly in fiscal year 2008 but still remained higher than 2004 and 2005 levels. These total figures and trends from the technology transfer activities of the Federal government represent steady, mature programs, as shown by the volume of CRADAs, licensing, patenting, and earned royalty income activities.

In Table 1, "Traditional CRADAs" refer to collaborative research and development by a Federal laboratory and non-Federal partners. "Non-traditional CRADAs" are used with non-Federal collaborators for special purposes such as material transfers, specialized equipment calibrations or other technical assistance which may produce information which needs to be protected from disclosure. In table 3, "other IP licenses" include licenses for copyrighted software (not including open source software licenses, which are also copyrighted software), open channel-web and noncommercial software, biological materials, and other forms of intellectual property.

Table 1: Collaborative Relationships for Research and Development

		FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
DHS	● **CRADAs**, total active in the FY	-	-	-	-	23
	- New, executed in the FY	-	-	-	-	8
	▪ Traditional CRADAs, total active in the FY	-	-	-	-	21
	▪ Non-traditional CRADAs, total active in FY	-	-	-	-	2
	▪ Other collaborative R&D relationships	-	-	-	-	3
DOC	● **CRADAs**, total active in the FY	1,969	1,904	3,008	2,778	2,390
	- New, executed in the FY	1,790	1,764	2,158	1,865	1,583
	▪ Traditional CRADAs, total active in the FY	67	80	149	154	131
	▪ Non-traditional CRADAs, total active in FY	1,902	1,826	2,859	2,624	2,259
	▪ Other collaborative R&D relationships	2,301	2,714	2,769	3,414*	3,476
DOD	● **CRADAs**, total active in the FY	2,833	2,736	2,999	2,971	2,596
	- New, executed in the FY	786	679	705	641	745
	▪ Traditional CRADAs, total active in the FY	2,425	2,736	2,424	2,383	1,993
	▪ Non-traditional CRADAs, total active in FY	408	474	575	588	603
	▪ Other collaborative R&D relationships	0	0	0	0	3
DOE	● **CRADAs**, total active in the FY	610	644	631	697	711
	- New, executed in the FY	157	164	168	182	178
	▪ Traditional CRADAs, total active in the FY	610	644	631	697	711
	▪ Non-traditional CRADAs, total active in FY	n/r	n/r	n/r	n/r	n/r
	▪ Other collaborative R&D relationships	0	0	0	0	0
DOI	● **CRADAs**, total active in the FY	61	70	82	170	170
	- New, executed in the FY	16	21	38	112	98
	▪ Traditional CRADAs, total active in the FY	45	49	31	20	33
	▪ Non-traditional CRADAs, total active in FY	16	21	51	150	137
	▪ Other collaborative R&D relationships	0	0	0	0	0
DOT	● **CRADAs**, total active in the FY	0	57	59	36	23
	- New, executed in the FY	0	5	6	7	6
	▪ Traditional CRADAs, total active in the FY	0	55	59	36	23
	▪ Non-traditional CRADAs, total active in FY	0	2	0	0	0
	▪ Other collaborative R&D relationships	0	0	0	0	0
EPA	● **CRADAs**, total active in the FY	104	107	94	84	112
	- New, executed in the FY	23	33	16	18	49
	▪ Traditional CRADAs, total active in the FY	82	95	83	67	74
	▪ Non-traditional CRADAs, total active in FY	22	12	11	17	38
	▪ Other collaborative R&D relationships	0	0	0	0	0

Table 1: Collaborative Relationships for Research and Development (continued)

		FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
HHS	● **CRADAs**, total active in the FY	220	215	164	284*	453
	- New, executed in the FY	95	101	66	68*	83
	▪ Traditional CRADAs, total active in the FY	119	117	92	206	295
	▪ Non-traditional CRADAs, total active in FY	101	98	72	79	158
	▪ Other collaborative R&D relationships	0	0	0	0	0
NASA	● **CRADAs**, total active in the FY	0	1	1	1	1
	- New, executed in the FY	0	1	0	0	1
	▪ Traditional CRADAs, total active in the FY	0	1	1	1	1
	▪ Non-traditional CRADAs, total active in FY	0	0	0	0	0
	▪ Other collaborative R&D relationships	3,987	4,025	3,492	2,666	2,463
USDA	● **CRADAs**, total active in the FY	205	199	195	230	252
	- New, executed in the FY	44	55	57	69	76
	▪ Traditional CRADAs, total active in the FY	185	171	163	184	202
	▪ Non-traditional CRADAs, total active in FY	20	28	22	23	28
	▪ Other collaborative R&D relationships	1,166	5,028	3,477	4,084	5,466
VA	● **CRADAs**, total active in the FY	13*	14*	35*	75	192
	- New, executed in the FY	4*	3	24	47*	134
	▪ Traditional CRADAs, total active in the FY	13*	14*	33*	71*	180
	▪ Non-traditional CRADAs, total active in FY	0	0	2*	4*	10
	▪ Other collaborative R&D relationships	0	0	0	0	0
TOTALS	● **CRADAs**, total active in the FY	6,015*	5,947*	7,268*	7,326*	6,923
	- New, executed in the FY	2,915*	2,826	3,238	3,009*	2,961
	▪ Traditional CRADAs, total active in the FY	3,546*	3,962*	3,666*	3,819*	3,664
	▪ Non-traditional CRADAs, total active in FY	2,469	2,461	3,592*	3,485*	3,235
	▪ Other collaborative R&D relationships	7,454	11,767	9,738	10,164*	11,411

- DHS began compiling and reporting data in 2008.
n/r = Data not reported.
* Reflects data correction from FY 2007 Summary Report.

Table 2: Invention Disclosure and Patenting

		FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
DHS	● New inventions disclosed in the FY	-	-	-	-	10
	● Patent applications filed in the FY	-	-	-	-	0
	● Patents issued in the FY	-	-	-	-	1
DOC	● New inventions disclosed in the FY	25	21	14	32	40
	● Patent applications filed in the FY	12	12	5	8*	21
	● Patents issued in the FY	12	10	7	3*	2
DOD	● New inventions disclosed in the FY	1,369	534	1,056	838	1,018
	● Patent applications filed in the FY	517	354	691	597	590
	● Patents issued in the FY	426	191	472	425	462
DOE	● New inventions disclosed in the FY	1,617	1,776	1,694	1,575	1,460
	● Patent applications filed in the FY	661	812	726	693	904
	● Patents issued in the FY	520	467	438	441	370
DOI	● New inventions disclosed in the FY	6	4	5	7	7
	● Patent applications filed in the FY	6	3	2	5	7
	● Patents issued in the FY	9	9	5	6	1
DOT	● New inventions disclosed in the FY	0	4	3	2	3
	● Patent applications filed in the FY	2	5	3	2	0
	● Patents issued in the FY	0	2	0	3	2
EPA	● New inventions disclosed in the FY	18	12	12	16	9
	● Patent applications filed in the FY	12	13	13	15	6
	● Patents issued in the FY	11	9	10	10	4
HHS	● New inventions disclosed in the FY	461	452	442	447	437
	● Patent applications filed in the FY	216	230	166	261	164
	● Patents issued in the FY	167	154	164	379	278
NASA	● New inventions disclosed in the FY	1,612	1,678	1,705	1,268	1084
	● Patent applications filed in the FY	207	202	196	105	110
	● Patents issued in the FY	189	133	144	93	112
USDA	● New inventions disclosed in the FY	142	125	105	126	133
	● Patent applications filed in the FY	81	88	83	114	123
	● Patents issued in the FY	50	27	39	37	30

Table 2: Invention Disclosure and Patenting (continued)

		FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
VA	● New inventions disclosed in the FY	204	165	157	175	164
	● Patent applications filed in the FY	54	26	27	25	13
	● Patents issued in the FY	7	10	5	8	10
TOTALS	● New inventions disclosed in the FY	5,454	4,771	5,193	4,486	4,365
	● Patent applications filed in the FY	1,768	1,745	1,912	1,825*	1,938
	● Patents issued in the FY	1,391	1,012	1,284	1,405*	1,272

- DHS began compiling and reporting data in 2008.
* Reflects data correction from FY 2007 Summary Report.

Table 3: Profile of Active Licenses

		FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
DHS	● **All licenses**, number total active in the FY	-	-	-	-	18
	▫ New, executed in the FY	-	-	-	-	0
	▪ **Invention licenses**, total active in the FY	-	-	-	-	0
	▫ New, executed in the FY	-	-	-	-	0
	▪ **Other IP licenses**, total active in the FY	-	-	-	-	18
DOC	● **All licenses**, number total active in the FY	125	133	111	222*	29(1)
	▫ New, executed in the FY	100	108	83	187	2(1)
	▪ **Invention licenses**, total active in the FY	125	133	111	222	29(1)
	▫ New, executed in the FY	100	108	83	187	2(1)
	▪ **Other IP licenses**, total active in the FY	0	0	0	0	0
DOD	● **All licenses**, number total active in the FY	369	412	444	460	342
	▫ New, executed in the FY	60	60	56	67	52
	▪ **Invention licenses**, total active in the FY	364	406	438	460	351
	▫ New, executed in the FY	60	60	56	67	52
	▪ **Other IP licenses**, total active in the FY	5	6	6	35	14
DOE	● **All licenses**, number total active in the FY	4,345	5,677	5,916	5,842	6,196
	▫ New, executed in the FY	616	750	652	606	685
	▪ **Invention licenses**, total active in the FY	1,362	1,535	1,420	1,354	1,418
	▫ New, executed in the FY	168	198	203	164	177
	▪ **Other IP licenses**, total active in the FY	2,983	4,142	4,496	4,488	4,748
DOI	● **All licenses**, number total active in the FY	13	20	21	15	19
	▫ New, executed in the FY	3	5	1	1	1
	▪ **Invention licenses**, total active in the FY	12	19	20	15	18
	▫ New, executed in the FY	3	5	1	0	1
	▪ **Other IP licenses**, total active in the FY	1	1	1	0	1

Table 3: Profile of Active Licenses (continued)

		FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
DOT	● **All licenses**, number total active in the FY	1	5	5	5	5
	▫ New, executed in the FY	0	4	0	0	0
	▪ Invention licenses, total active in the FY	1	5	5	1	5
	▫ New, executed in the FY	0	4	4	0	0
	▪ Other IP licenses, total active in the FY	0	0	0	0	0
EPA	● **All licenses**, number total active in the FY	38	39	35	38	37
	▫ New, executed in the FY	7	4	2	5	2
	▪ **Invention licenses**, total active in the FY	38	39	35	38	37
	▫ New, executed in the FY	7	4	2	5	2
	▪ **Other IP licenses**, total active in the FY	0	0	0	0	0
HHS	● **All licenses**, number total active in the FY	1,424	1,532	1,535	1,418	1,675
	▫ New, executed in the FY	288	349	290	293	277
	▪ **Invention licenses**, total active in the FY	1,173	1,237	1,213	915	1,376
	▫ New, executed in the FY	249	291	253	234	233
	▪ **Other IP licenses**, total active in the FY	251	295	322	460	352
NASA	● **All licenses**, number total active in the FY	861	1,338	1,675	1,883	2,296
	▫ New, executed in the FY	423	505	375	261	307
	▪ **Invention licenses**, total active in the FY	338	441	477	461	457
	▫ New, executed in the FY	107	129	73	28	26
	▪ **Other IP licenses**, total active in the FY	523	897	1,198	1,422	1,839
USDA	● **All licenses**, number total active in the FY	296	320	332	339	328
	▫ New, executed in the FY	29	33	25	25	28
	▪ **Invention licenses**, total active in the FY	296	320	332	339	328
	▫ New, executed in the FY	29	33	25	25	28
	▪ **Other IP licenses**, total active in the FY	0	0	0	0	0
VA	● **All licenses**, number total active in the FY	95	101	112	130	153
	▫ New, executed in the FY	9	6	11	18	23
	▪ **Invention licenses**, total active in the FY	95	101	112	130	153
	▫ New, executed in the FY	9	6	11	18	23
	▪ **Other IP licenses**, total active in the FY	12	0	0	0	0

Table 3: Profile of Active Licenses (continued)

		FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
TOTALS	● **All licenses**, number total active in the FY	7,567	9,577	10,186	10,352*	11,098
	▫ New, executed in the FY	1,535	1,824	1,495	1,463	1,377
	▪ **Invention licenses**, total active in the FY	3,804	4,236	4,163	3,935	4,172
	▫ New, executed in the FY	732	838	711	728	544
	▪ **Other IP licenses**, total active in the FY	3,775	5,341	6,023	6,405	6,972

- DHS began compiling and reporting data in 2008.
* Reflects data correction from FY 2007 Summary Report.

(1) The number of licenses for FY 2008 has decreased because the Institute for Telecommunication Sciences (ITS) no longer licenses Video Quality Metric Technology (VQM). Instead ITS made this software widely available via open source download.

Table 4: Characteristics of Licensing Bearing Income

		FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
DHS	● **All income bearing licenses**, number	-	-	-	-	0
	▫ Exclusive	-	-	-	-	0
DOC	● **All income bearing licenses**, number	23	25	30	35	25
	▫ Exclusive	11	12	17	16	14
DOD	● **All income bearing licenses**, number	103	110	112	194	210
	▫ Exclusive	48	59	64	84	70
DOE	● **All income bearing licenses**, number	3,236	2,549	2,822	3,291	4,397
	▫ Exclusive	255	248	353	352	372
DOI	● **All income bearing licenses**, number	14	18	18	14	16
	▫ Exclusive	8	9	9	4	5
DOT	● **All income bearing licenses**, number	1	5	4	4	4
	▫ Exclusive	1	2	3	2	1
EPA	● **All income bearing licenses**, number	38	39	35	38	37
	▫ Exclusive	8	5	6	6	7
HHS	● **All income bearing licenses**, number	758	816	849	901	1057
	▫ Exclusive	121	127	134	144	149
NASA	● **All income bearing licenses**, number	225	235	244	236	248
	▫ Exclusive	103	103	106	106	112
USDA	● **All income bearing licenses**, number	294	318	330	337	313
	▫ Exclusive	200	220	233	241	223
VA	● **All income bearing licenses**, number	74	82	93	115	137
	▫ Exclusive	9	14	24	44	61
TOTALS	● **All income bearing licenses**, number	4,766*	4,197*	4,537*	5,165*	6,444
	▫ Exclusive	764*	799*	949*	999*	1,014

- DHS began compiling and reporting data in 2008.
(*) Reflects data correction from FY 2007 Summary Report.

Table 5: Income from Licensing (Dollars reported in thousands)

		FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
DHS	● **Total income**, all licenses active in FY	-	-	-	-	$0
	▪ **Invention licenses**	-	-	-	-	$0
	▪ **Other IP licenses**, total active in the FY	-	-	-	-	$0
	● **Total Earned Royalty Income**, (ERI)	-	-	-	-	$0
DOC	● **Total income**, all licenses active in FY	$203	$147	$194	$225	$293
	▪ **Invention licenses**	$203	$147	$194	$225	$293
	▪ **Other IP licenses**, total active in the FY	$0	$0	$0	$0	$0
	● **Total Earned Royalty Income**, (ERI)	$170	$139	$170	$217	$293
DOD	● **Total income**, all licenses active in FY	$9,204	$10,650	$10,963	$14,246	$16,057
	▪ **Invention licenses**	$9,199	$10,637	$10,961	$14,240	$16,048
	▪ **Other IP licenses**, total active in the FY	$5	$13	$2	$6	$9
	● **Total Earned Royalty Income**, (ERI)	n/a	n/a	n/a	n/a	n/a
DOE	● **Total income**, all licenses active in FY	$27,252	$27,382	$35,572	$39,165	$49,318
	▪ **Invention licenses**	$23,321	$24,226	$32,211	$34,933	$43,108
	▪ **Other IP licenses**, total active in the FY	$3,931	$3,156	$3,362	$4,233	$6,210
	● **Total Earned Royalty Income**, (ERI)	$10,882	$12,443	$18,332	$18,759	$31,718
DOI	● **Total income**, all licenses active in FY	$48	$71	$47	$57	$79
	▪ **Invention licenses**	$48	$71	$47	$57	$79
	▪ **Other IP licenses**, total active in the FY	n/a	n/a	n/a	n/a	n/a
	● **Total Earned Royalty Income**, (ERI)	$45	$68	$46	$57	$79
DOT	● **Total income**, all licenses active in FY	$0	$37	$22	$34	$18
	▪ **Invention licenses**	$0	$22	$22	$34	$18
	▪ **Other IP licenses**, total active in the FY	$0	$15	$0	$0	$0
	● **Total Earned Royalty Income**, (ERI)	$0	$22	$22	$34	$9
EPA	● **Total income**, all licenses active in FY	$762	$666	$632	$544	$1,038
	▪ **Invention licenses**	$762	$666	$632	$544	$1,038
	▪ **Other IP licenses**, total active in the FY	$0	$0	$0	$0	$0
	● **Total Earned Royalty Income**, (ERI)	$205	$34	$29	$107	$571
HHS	● **Total income**, all licenses active in FY	$56,479	$98,542	$83,097	$88,799	$97,609
	▪ **Invention licenses**	$56,170	$96,485	$82,187	$67,108	$94,712
	▪ **Other IP licenses**, total active in the FY	$309	$2,057	$909	$19,128	$2,897
	● **Total Earned Royalty Income**, (ERI)	$39,456	$76,695	$63,250	$70,743	$80,805

Table 5: Income from Licensing (Dollars reported in thousands) (continued)

		FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
NASA	● **Total income**, all licenses active in FY	$3,124	$3,935	$4,862	$2,912	$2,395
	▪ **Invention licenses**	$3,036	$3,935	$4,726	$2,912	$2,395
	▪ **Other IP licenses**, total active in the FY	$89	n/a	$136	n/a	n/a
	● **Total Earned Royalty Income**, (ERI)	$929	$1,333	$2,162	$1,352	$1,159
USDA	● **Total income**, all licenses active in FY	$2,164	$3,315	$3,162	$3,588	$3,953
	▪ **Invention licenses**	$2,164	$3,315	$3,162	$3,588	$3,953
	▪ **Other IP licenses**, total active in the FY	$0	$0	$0	$0	$0
	● **Total Earned Royalty Income**, (ERI)	$1,427	$2,089	$2,337	$2,682	$3,010
VA	● **Total income**, all licenses active in FY	$279	$117	$138	$358	$141
	▪ **Invention licenses**	$279	$117	$138	$358	$141
	▪ **Other IP licenses**, total active in the FY	n/a	n/a	n/a	n/a	n/a
	● **Total Earned Royalty Income**, (ERI)	n/a	n/a	n/a	n/a	n/a
TOTAL	● **Total income**, all licenses active in FY	$99,515*	$144,862*	$138,689*	$149,928*	$170,901
	▪ **Invention licenses**	$95,182*	$139,621*	$134,280*	$123,999*	$161,785
	▪ **Other IP licenses**, total active in the FY	$4,334	$5,241*	$4,409	$23,367	$9,116
	● **Total Earned Royalty Income**, (ERI)	$53,114	$92,823*	$86,348*	$93,951*	$117,644

- DHS began compiling and reporting data in 2008.
n/a = Data not available from agency.
(*) Reflects data correction from FY 2007 Summary Report.

CHAPTER 3

Outcomes and Impact of Technology Transfer Activities

Reports of the successful commercialization of Federally-developed technologies cut across industrial sectors and demonstrate the broad reach of technology transfer into the lives of American citizens. The cases provided below are examples of the downstream outcomes arising from technology transfer activities.

Department of Agriculture (USDA)

The Agriculture Research Service (ARS) conducts research to develop and transfer solutions to agricultural problems of high national priority to:
• ensure a high-quality, safe, abundant food supply;
• assess the nutritional needs of Americans;
• sustain a competitive agricultural economy;
• enhance U.S. natural resources and the environment; and to
• provide economic opportunities for rural citizens, communities, and society as a whole

In fiscal year 2008, ARS established a new initiative to promote adoption of agricultural research results in a manner that supports local/regional economic development. Traditionally, innovation and small business development have been critical to the nation's global competitiveness and in achieving sustainable local/regional economic development. The global economic downturn of 2008 has further highlighted the urgency to focus on innovation, competitiveness, and job creation. Thus, to help meet these challenges and enhance partnering with small businesses, ARS has initiated an Agricultural Technology Innovation Partnership (ATIP) program to facilitate adoption of ARS research outcomes by private sector companies for commercial production of goods and services. Key to this initiative is the use of Partnership Intermediary Agreements (PIA) with technology-based economic development entities. Intermediaries are strategically chosen by geographic region and for their ability to serve small businesses by providing assets complementary to ARS's research and innovation capacities.

More information about USDA technology transfer please visit:
ARS: http://www.ars.usda.gov/partnering
Forest Service: http://www.fs.fed.us

- **Improving Dairy Products Using Hi-Tech Tools**

In order to assure high quality beef and dairy products, the existing genetic makeup of cattle must be evaluated. The genetic traits of cattle directly affect the quality of beef and dairy products.

"Progeny testing," the method now used to determine a bull's genetic merit, is time-consuming and costly. Because a bull cannot be evaluated directly for the milk production traits or meat quality traits of its offspring, like tenderness or flavor, a ranch owner must generate many cows from a single bull, wait for the cows to mature and have

a calf, to begin producing milk. Ultimately a rancher must wait years to see how different cows compare to offspring from competing bulls.

ARS researchers in Maryland and Nebraska are trying to speed this process, and make it more efficient, by using more precise techniques to look at a cattle's genetic makeup—DNA markers. Using technology originally developed in the human genome project—the BeadChip—ARS scientists worked with university professors and Illumina (the San Diego firm that manufactures BeadChip) to design a chip for genomics-based studies on dairy cattle. The researchers developed a new genomic method—called "genome-enhanced improvement"—to identify bulls that produce progeny with optimum milk production and other traits.

The BeadChip can be used to specifically characterize single DNA markers over 58,000 locations, distributed relatively evenly across the bovine genome. The researchers are using this tool to examine DNA from 15,000 cows and bulls, representing several commercial dairy and beef breeds and ARS populations. This technology has revolutionized breeding efforts. The information is used to correlate DNA data to traits of interest, such as milk, fat, and protein production. Eventually, information derived from the markers will help dairy and beef producers streamline their identification and breeding efforts. Cutting test costs, while increasing genetic improvement in dairy cattle, will help make the U.S. breeding industry more globally competitive, and will benefit the domestic economy.

ARS researchers worked with Illumina to commercialize a new hi-tech tool, the BovineSNP50. Since its commercial availability in early 2008, sales of the BovineSNP50 total more than 200,000 samples (approximately $25 million) for 23 scientific locations in 11 countries. The research was so intriguing and valuable to scientists worldwide that the researchers formed the iBMC consortium—(a consortium consisting of Illumina, Beltsville (ARS), Missouri University and Clay Center (ARS))—to continue sharing and exploring genetic data generated using the BeadChip. In addition, other consortiums have been formed to evaluate using the technology to identity genetically important traits in sheep and pigs.

The iBMC Consortium team won one the USDA's 2008 Outstanding Effort Technology Transfer Awards for this work, and a 2009 Federal Laboratory Consortium (FLC) Annual Award for Excellence in Technology Transfer.

- **Protecting U.S. Troops Against Insect-Borne Illness**

ARS researchers in Gainesville, FL, teamed with the U.S. Marine Corps (USMC) to help solve a key problem—improving uniforms' mosquito protection capabilities. Diseases transmitted by mosquitoes, like Malaria, West Nile virus, and Yellow Fever have a significant impact on military operations, both today and historically.

Traditional methods of evaluating the efficacy of bug repellants applied to Army uniforms were not good indicators of how protective a uniform was, nor were they precise enough to qualify or disqualify uniforms factory-treated with bug repellent.

Treating military uniforms is a multi-billion dollar industry, and properly treated uniforms can save the military time and money in medical expenses and disease treatment and can improve the efficacy of military units.

ARS researchers devised a rigorous protocol to assess the ability of repellent-treated uniforms to protect from mosquito bites—a novel and logical indicator of disease risk. The process determines the number of bites received by a volunteer wearing a treated uniform and corrects for the untreated uniform to provide a more realistic and valid indicator of repellent efficacy. The USMC adopted ARS's procedure as the "standard" for qualifying companies that factory-treat uniforms with repellent.

In 2007, qualified contractors treated the USMC's entire stock of 384,000 Marine Corps Combat Utility Uniforms. The treated uniforms provide more than 90% bite protection for more than 50 wash cycles—exceeding uniforms' maximum life. The Natick Soldier Center, which oversees development of U.S. Army uniforms, is now using the ARS technology to evaluate uniform treatment and to guide development of more than four million uniforms—including new Fire Resistant Army Combat Uniforms, manufactured from flame-resistant fabrics.

Medical treatment of individual personnel infected with diseases obtained from insects can cost over 100 times more than a properly treated uniform. ARS's technological contributions have had a significant impact in protecting American service personnel from illness, and have resulted in cost savings to the Federal government and U.S. taxpayers.

- **Nutritious Food Based Wraps**

A rainbow of new flavorful, healthy sushi-type wraps will be appearing soon on a menu near you. Food technologists at ARS's Processed Foods Research Unit in Albany, CA, developed (and filed for patent protection) fruit and vegetable sheet wraps, or sheets that can be used in the culinary arts and food preparation. Along with CRADA partner Origami Foods, LLC of Pleasanton, CA, ARS developed a variety of food based wraps to envelop any number of fillings, including bright-orange carrot-based wraps, deep-red tomato and basil wraps, pineapple-apricot-ginger wraps, broccoli wraps, and even blueberry and strawberry wraps for desserts.

All the wraps are at least 75 percent vegetable or fruit, and include other wholesome natural ingredients. Besides being fun to eat, the sushi-style delicacies are ideal for weight-conscious Americans trying to control portion size.

The researchers perfected the formulations—with culinary input from two well-known sushi chefs and other food industry experts—and techniques for making the wraps at ARS's pilot plant at the Western Regional Research Center in California. Origami recently opened a factory with six full-time employees in Stockton, California, a rural area in need of new employment opportunities, to mass-produce the product. The San Joaquin County Revolving Loan Fund (local government unit), approved financing for the factory and provided assistance in selecting a site and providing permits.

The carrot wraps are available on Sunny California Roll sushi products around the country in Trader Joes stores, and the apple wraps are available on spiral cut hams as glaze sheets.

Department of Commerce (DOC)

At the Department Commerce, R&D in numerous areas of science and technology is conducted at the National Institute of Standards and Technology (NIST), the National Oceanic and Atmospheric Administration (NOAA), and the Institute for Telecommunication Sciences (ITS) within the National Telecommunications and Information Administration.

More information about DOC technology transfer is available on the following websites:
NIST: http://patapsco.nist.gov/ts/220/external/index.htm
NOAA: http://www.noaa.gov/
ITS: http://www.its.bldrdoc.gov/programs/tech_transfer/

National Institute of Standards and Technology

NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve quality of life. NIST laboratories develop and disseminate measurement techniques, reference data, test methods, standards, and other infrastructural technologies and services that support U.S. industry, scientific research, and the activities of many federal agencies. In carrying out its mission, NIST works directly with industry partners (and consortia), universities, associations, and other government agencies.

- **World Trade Center Study Inspires Strengthened International Building, Fire Codes**

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

The changes, adopted at the ICC hearings held Sept. 15-21, 2008, in Minneapolis, Minn., will be incorporated into the 2009 edition of the ICC's I-Codes (specifically the International Building Code, or IBC, and the International Fire Code, or IFC), a state-of-the-art model code used as the basis for building and fire regulations promulgated and enforced by U.S. state and local jurisdictions. Those jurisdictions have the option of incorporating some or all of the code's provisions, but historically adopt most provisions. The new codes address areas such as increasing structural resistance to building collapse from fire and other incidents; requiring a third exit stairway for tall buildings; increasing the width of all stairways by 50 percent in new high-rises; strengthening criteria for the

bonding, proper installation and inspection of sprayed fire-resistant materials (commonly known as "fireproofing"); improving the reliability of active fire protection systems (i.e., automatic sprinklers); requiring a new class of robust elevators for access by emergency responders in lieu of an additional stairway; making exit path markings more prevalent and more visible; and ensuring effective coverage throughout a building for emergency responder radio communications.

- **Building Software Offers Green Product Advice**

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

BEES 4.0 (Building for Environmental and Economic Sustainability version 4) measures both the environmental and economic performance of building products with life-cycle assessment techniques developed respectively by the International Organization of Standardization (ISO) and American Society for Testing and Materials (ASTM) International.

- **American Society for Testing and Materials**

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

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

BEES 4.0 includes a number of new non-biobased products, including carpeting from several manufacturers who agree to purchase carbon credits to offset the product's life-cycle greenhouse gas emissions. These and other products, such as biobased carpets, roof

coatings, building maintenance products and fertilizers that qualify for a government "green" preferential purchase program, could increase builder participation in the nation's general push for green buildings.

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

National Oceanic and Atmospheric Administration

The mission of the National Oceanic and Atmospheric Administration (NOAA) is to understand and predict changes in the Earth's environment and conserve and manage coastal and marine resources to meet the Nation's economic, social, and environmental needs. This mission will become ever more critical in the 21st century as national needs intensify concerning global warming, freshwater supply, ecosystem management, and homeland security.

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

The first Deep-ocean Assessment and Reporting of Tsunamis (DART®) station was launched in the Indian Ocean in December 2006. In FY2008, NOAA's Pacific Marine Environmental Laboratory (PMEL) continued to support efforts to transfer tsunami-detection related technology used to improve warnings world-wide. Familiarization and training were provided to the Science Applications International Corporation DART® team from September 22 through Oct 3, 2008 in support of the Special Studies Agreement to assist the technology transfer to the commercial sector. Two separate Memoranda of Understanding (MOU) in place with Indonesia and Australia, resulted in Australia's establishment of a second DART® station supported by Australia, located in the Coral Sea. A training deployment cruise from Indonesia was undertaken by PMEL and Indonesian engineers in June, 2008 under the auspices of the U.S. Agency for International Development (USAID) MOU. Data from all DART® buoys is available on line in real-time: http://www.ndbc.noaa.gov/dart.shtml.

Department of Defense (DoD)

The purpose of the Office of Technology Transition is to ensure, to the maximum extent practicable, that 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.

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/sci_tech/3t/transition/tech_tran/
http://www.wpafb.af.mil/library/factsheets/factsheet.asp?id=6026
http://www.mda.mil/mdalink/html/transfer.html
http://www.nsa.gov/techtrans/index.cfm
http://www.jfcom.mil/about/industry.htm

- **U.S. Army's Bleeding Simulation System Goes Commercial**

The Field Expedient Bleeding Simulation System is an interactive casualty simulation tool that, when coupled with professional educators and exercises, provides a chaotic, hectic, yet controlled learning environment for Combat Medics. The Field Expedient Bleeding Simulation System was developed by former Army Medic Trainer Sergeant Lynn Randall King at the U.S. Army Medical Research and Materiel Command Center and School's Fort Carson 91W School satellite program.

Existing training tools didn't sufficiently recreate the stress and difficulty of managing hemorrhaging from wounds and shock control on the battlefield. Making training as real as possible is a key to having trainees be as prepared as possible before they face the intensity of treating actual casualties with severe bleeding. To this end, the Field Expedient Bleeding Simulation System can be installed or retrofitted into training mannequins or sewn into apparel worn by training personnel. Bladder bags can pump simulated blood from tubes placed throughout the system. Through the use of a wireless remote control, the amount of bleeding from "wounds" can vary and differ in terms of intensity, pressure, and location.

The U.S. Army Medical Research and Materiel Command (AMEDD) signed a CRADA and facilitated a license of the FEBSS technology with SKEDCO, Inc. of Tualatin, Oregon. SKEDCO has delivered over 100 units to train Combat Medics and is starting to make sales to schools for paramedic training.

- **Trivalent Chromium Processes**

Researchers at the Naval Air Warfare Center Aircraft Division, Patuxent River, MD, developed a suite of patents that provide non-carcinogenic anti-corrosion coatings for multiple finishes collectively known as Trivalent Chromium Processes (TCP). Originally TCP were developed to protect Navy aircraft at sea as an alternative to hexavalent-chromium (HC), a widely used but toxic corrosion inhibitor.

The vast potential in the private sector for TCP led the Navy technology transfer team to begin a multidisciplinary effort to get it to market. The effort included establishing a standard of licensing multiple patents to multiple companies in both national and international markets.

The enormous effort paid off as TCP was licensed to four companies that have already earned millions in sales of TCP-based products and are now reaching new markets. TCP is now being used throughout the military, including the new Marine Corps

Expeditionary Fighting Vehicle, H-64 helicopter, Navy H-60R/S helicopter, and the Marine Corps H-53K helicopter.

- **Ultra High-Pressure (UHP) Water Firefighting Technology**

Researchers at the Air Force Research Laboratory Materials and Manufacturing Directorate developed an ultra high-pressure water fire-fighting apparatus designed with an emphasis on extinguishing hydrocarbon fuel fires. The Air Force needed a reliable, lightweight, compact fire truck that could easily fit into a C-130 aircraft.

The First Response Expeditionary Vehicle, an air-deployable All-Terrain Vehicle with a mounted Ultra High-Pressure system, was developed by the Air Force Fire Research Group and currently is the only fire fighting asset in the Air Force inventory capable of being dropped from an aircraft. Coupled with a Ultra High Pressure P-19 turret that is capable of supporting Ultra High Pressure water technology, compressed air foam, and dry chemical agent, the First Response Expeditionary Vehicle allows the application of the agent more efficiently while improving visibility for the firefighters because they can see both the agent stream as well as the target from one vantage point.

After extensive testing and system optimization, the First Response Expeditionary Vehicle was transitioned for commercial production through Rosenbauer America and HMA Fire by way of a CRADA. The Air Force plans to procure an initial order of 90 units, with a grand total of 200 units projected.

Department of Energy (DOE)

The Department of Energy's seventeen national laboratories conduct much of its fundamental and applied research, and they license to and collaborate with industry and academia to develop and commercialize energy products and processes for commercial use. Technology partnering in a broad sense has been an important focus for DOE technology transfer, and it is a significant means for DOE laboratories and facilities to engage Federal, private and academic entities in arrangements to advance the process of technology development and commercialization. These arrangements leverage capabilities found in DOE facilities, including national user facilities, computational facilities, and science laboratories, with industrial research and production facilities.

The Department oversees the construction and operation of some of the Nation's most advanced research and development user facilities, located at national laboratories and universities. These state-of-the-art facilities are shared with the science community worldwide and offer some technologies and instrumentation that are available nowhere else. These facilities include particle and nuclear physics accelerators, synchrotron light sources, neutron scattering facilities, genome sequencing facilities, supercomputers, and high-speed computer networks. In the 2007 fiscal year, these facilities were used by more than 21,000 researchers from universities, national laboratories, private industry, and other federal science agencies. One of the newest is the Spallation Neutron Source, an accelerator-based neutron source in Oak Ridge, Tennessee, a one-of-a-kind facility that provides the most intense pulsed neutron beams in the world for scientific research

and industrial development. The most recent facility to come on line is the National Ignition Facility. As the world's largest and highest-energy laser, this facility will provide the scientific community with an unprecedented capability for studying materials at extreme pressures, temperatures and densities.

In an effort to enhance technology transfer activities and facilitating access to its facilities, the Department recently instituted two new model agreements available to academia and industry. These are pre-approved, standardized model agreements, one for proprietary research, and the other for non-proprietary research. The agreements are authorized for use at all designated DOE user facilities at all DOE laboratories. Prospective users may use the same applicable general agreement at every facility. The agreements are intended to require minimal, if any, further negotiation and to be quickly executable. This new approach will allow both university and industrial researchers greater access to the DOE specialized facilities across the DOE laboratory system, permitting them to work more closely with scientists at the national laboratories.

More information about the DOE technology transfer program and the new model agreements can be found at:
http://www.science.doe.gov/Technology_Transfer/overview.htm

- **Inexpensive Fuel Cell Catalysts**

Sandia National Laboratories (SNL) researchers have developed innovative methods of producing platinum catalysts that offer much greater control over the shape, size, porosity, composition, stability, and other functional properties of platinum nanostructures than those achieved by existing methods. Most fuel cells use platinum or platinum alloys as catalysts. However, the limited supply of platinum is a potential barrier to widespread fuel cell use. These highly efficient and durable nanostructured catalysts are expected to reduce the amount of platinum needed and thus reduce the cost of platinum catalysts for use in fuel cells, solar cells, and other applications in the renewable energy sector. SNL has licensed these platinum catalysts for use in the fuel cell field to Compass Metals, Inc.

Under a multi-year cooperative research and development agreement, Sandia and Compass Metals are also collaborating to improve further the synthesis of platinum nanomaterials in large-scale preparations, to determine the best methods for incorporating these new nanomaterials in the fabrication of fuel cell electrodes and to discover new nanomaterials.

Compass Metals is scaling up preparation of the existing SNL catalysts, and those developed through the collaboration, and will work with established fuel cell manufacturers in the United States to evaluate these new catalysts and integrate them into existing fuel cell designs.

SNL is managed and operated under contract to the DOE National Nuclear Security Administration by the Sandia Corporation, a Lockheed Martin company.

- **Optical Furnace Technology Sparks Solar Industry Interest**

Advanced optical furnace technology for manufacturing thin-film silicon solar cells, developed by the Department of Energy's National Renewable Energy Laboratory (NREL), has been recognized by Applied Optical Systems for its great potential in developing such solar cells with up to 15 to 18 percent higher efficiencies than presently available. This optical furnace technology will also make it possible to process a thin-film solar cell in only a few minutes, which reduces manufacturing costs. This advanced optical furnace is highly energy efficient, and it can be used to manufacture any type of thin-film solar cell; it can benefit any solar cell manufacturer.

Each type of solar cell or manufacturing process typically requires a different furnace configuration and temperature profile. With NREL's new optical furnace system, a solar cell manufacturer can ask a computer for any temperature profile needed for processing a solar cell, and the same type of furnace is suitable for several solar cell fabrication process steps.

For manufacturing these thin-film silicon cells, Applied Optical Systems and NREL have developed a partnership through a cooperative research and development agreement to construct an optical furnace system prototype. The U.S. Department of Energy has recognized the significant potential of this technology, and has provided funding through the Technology Commercialization Deployment Fund (TCDF) to develop the prototype design. The TCF Program has provided NREL with additional funds to expand such collaborative efforts between NREL researchers and companies.
"In the future, solar cell manufacturers will only need this one optical furnace because it can be used for any process, including diffusion, metallization and oxidation," says Bhushan Sopori, a principal engineer at NREL, "This helps reduce manufacturing costs."

NREL is managed and operated under contract to the DOE Office of Energy Efficiency and Renewable Energy (EERE) by the Alliance for Sustainable Energy, LLC, a joint venture between the Midwest Research Institute and the Battelle Memorial Institute.

- **Solid Electrolyte for Rechargeable Lithium Batteries**

Nanostructured polymer electrolyte (NPE) developed at the Department of Energy's Lawrence Berkeley National Laboratory (LBNL) is a solid electrolyte designed for use in rechargeable lithium batteries. Using this technology, which it has licensed from LBNL, Seeo, Inc., LBNL is now developing a completely solid-state rechargeable Li battery with the potential to overcome the energy density – or energy storage capacity - limitations and improve the safety and lifetime of rechargeable batteries. These batteries could be employed in electric and hybrid vehicles, cell phones, laptops, and medical devices, among other applications.

Solid-state batteries containing Berkeley Lab's NPE would introduce a radically new architecture with the potential to enable electric battery-driven transportation technology. LBNL's NPE exhibits high ionic conductivity and can be engineered to be mechanically rigid enough to resist the growth of dendrites, which cause batteries to short and sometimes explode. NPE-based batteries are inherently safe because they lack the reactive and flammable organic liquid electrolytes of conventional lithium ion batteries.

The safety of the new NPE may enable the use of a lithium metal anode in place of a traditional lithium ion anode, which would significantly enhance the energy density of the battery. Another advantage of LBNL's NPE is that it can readily be incorporated into casting and roll-to-roll processing methodologies already used in current lithium battery manufacturing.

Solid-state lithium ion batteries made possible by LBNL's NPE are expected to meet the energy density goal established by the Department of Energy for electric vehicles – the highest hurdle for battery technology. In addition, predictions based on recent tests indicate that the Seeo batteries will achieve the United States Advanced Battery Consortium (USABC) goal of 5,000 cycles.

LBNL's nanostructured polymer electrolyte technology as a basis for Seeo's batteries provides a strong opportunity to achieve vehicles that can be powered from the electric grid due to increasing quantities of mobile energy production, while also reducing greenhouse gas emissions.

LBNL is managed and operated under contract to the DOE Office of Science by the University of California.

Department of Health and Human Services (HHS)

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

The NIH has as its mission the conduct and support of biomedical research to improve the public health. The Office of Technology Transfer (OTT), Office of the Director, NIH, is responsible for identifying, evaluating, protecting and marketing technologies derived in NIH intramural laboratories. OTT transfers these technologies through licenses to the private sector, where they can be further developed into products used in the prevention, diagnosis, or treatment of disease.

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.

Therefore, NIH has a method for measuring technology transfer outcomes that focuses on the manner and extent to which technologies developed in NIH laboratories and transferred to commercial partners are meeting the NIH mission of improving the public health. NIH conducted ten case studies using this method. These case studies are a part of a series. The full ten case studies are available at:
http://www.ott.nih.gov/about_nih/success_stories.html#pdfLink

For more information about the HHS technology transfer program please visit:
CDC: http://www.cdc.gov/od/science/techTran
FDA: http://www.fda.gov/ScienceResearch/CollaborativeOpportunities/default.htm
NIH: http://www.ott.nih.gov/about_nih/about.aspx

- **Efficient Production Method Developed For Hib and Meningitis Vaccines (FDA)**

A new FDA technology provides for a rapid high efficacy conjugation method developed for production of polysaccharide-protein conjugate vaccines. Polysaccharide-protein conjugate vaccines are a new class of vaccines designed to immunize infants and healthy children against diseases caused by invasive bacteria, including *H influenzae* type b (Hib) and *meningitis.* Bacteria such as these are often difficult to vaccinate against effectively as their polysaccharide outer coats are poorly immunogenic. By linking these outer coats to proteins, the immune system can be led to recognize the polysaccharide as if it were a protein antigen and generate protective antibodies against it. The NIH Office of Technology Transfer licensed this technology for use for commercialization by organizations in India and South Africa.

- **New Treatment Licensed for Rare Disease Disorder in Children (NIH)**

New inventions at the NIH provide for a potential gene therapy treatment for a rare disease, Glycogen Storage Disease (GSD) Type I. GSD Type I is an inherited disorder that affects the metabolism - the way the body breaks food down into energy. Although is not known how many children die without ever having been properly diagnosed, children born with GSD I typically exhibit low blood sugar, an enlarged liver, failure to thrive, developmental delay and seizures. This technology, licensed to small business for commercial development, is an excellent example of a license agreement that supports the NIH's role in trying to address all categories of disease states, i.e., novel technologies are developed and licensed for small patient populations and not just for the blockbuster drugs. The NIH Office of Technology Transfer and the NIH intramural research program are particularly focused on meeting unmet health needs and these types of agreements are typical of their licensing efforts.

- **New Live Attenuated Vaccine against All Four Types of Dengue Infection (CDC)**

Vaccine discoveries at the CDC have formed the basis for a new live attenuated dengue fever vaccine. Dengue fever and dengue hemorrhagic fever are viral diseases that are among the most significant viral illnesses transmitted by mosquitoes to humans worldwide. Over 2.5 billion people, including travelers, are at risk of contracting dengue illness in countries in tropical regions of the world. The case fatality rate for dengue infections is about 5% in most countries, with most fatal cases occurring among children and young adults. This new vaccine discovery, along with new safety assays for it, has been licensed to a small biotechnology company for manufacture and testing in humans. The license agreement was completed by the CDC Office of Technology Transfer with a goal of bringing a safe and effective tetravalent dengue vaccine to save millions of lives and decrease the economic burdens cause by dengue disease.

Department of Homeland Security (DHS)

The Department of Homeland Security's Office of Research and Technology Applications (ORTA) was established in February 2008. Housed in the Science and Technology Directorate, the ORTA is responsible for developing and instituting policies to facilitate technology transfer in accordance with 15 USC 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.

The Department of Homeland Security has laboratories with varying capabilities throughout the United States. With the exception of the Coast Guard Research and Development Center, the DHS laboratories listed are within the Science and Technology Directorate. DHS Laboratories included in 2008's reported data are:

- Chemical Security Analysis Center (CSAC)
- Coast Guard Research and Development Center
- Environmental Measurements Laboratory (EML)
- National Biological Analysis and Countermeasures Center (NBACC)
- Plum Island Animal Disease Center (PIADC)
- Transportation Security Laboratory (TSL).

In addition, the Federal Law Enforcement Training Center (FLETC) provided data. The FLETC has the authority to conduct technology transfer.

For more information on DHS laboratories and their capabilities, visit the website at http://www.dhs.gov/xres/labs/

- **Trademark Licensing Program**

The Department of Homeland Security (DHS) has several trademarks that have been licensed to third-parties for use although no revenue is generated from such licensing. DHS has several programs that interface directly with the public and has developed names and logos to identify these programs. DHS claims common law trademark rights to several of these public facing program names and logos and has sought Federal protection through registration with the United States Patent and Trademark Office (USPTO). Federal registration is an important tool for DHS to legally protect itself

against those seeking to appropriate the DHS marks or use them for unauthorized endorsements. The DHS marks include TWIC™, E-VERIFY®, READY®, ESTA™, FLUX™, CYBER CORP™, GRaDER™, among many others. DHS' intellectual property policy, which is accessible on the dhs.gov website, provides notice to the public that authorization is needed to use any of the DHS marks.

The E-VERIFY® mark, for example, is one of the DHS marks that have been licensed to third parties. The E-VERIFY® mark is currently licensed to approximately 16 E-Verify participants. The E-Verify program is an internet based system operated by DHS in partnership with the Social Security Administration (SSA) that allows participating employers to electronically verify the employment eligibility of their newly hired employees. The E-VERIFY® license authorizes the participating employers to use the E-VERIFY® logo on their respective company advertising or marketing materials. Another example of DHS marks that are licensed to third parties are the Ready Campaign marks. The Ready Campaign is a national public service advertising campaign developed in partnership with the Advertising Council to educate and empower Americans to prepare for and respond to emergencies including natural disasters and potential terrorist attacks. DHS has a suite of logos and characters associated with the public service campaign and has granted at least one commercial entity and various state and local governmental organizations the limited right to use the READY® marks on products intended to support National Preparedness Month.

Department of the Interior (DOI)

The United States Geological Survey

The United States Geological Survey (USGS) is a bureau of the Department of the Interior. The mission of the USGS is to serve the nation by providing reliable scientific information to describe and understand the Earth, minimize loss of life and property from natural disasters, manage water, biological, energy, and mineral resources, and enhance and protect our quality of life.

Since delivery of science information is a primary purpose of the agency, technology transfer activities with the public sector and the private sector, including academia and non-profits, typically support the collection and transference of scientific data (knowledge dissemination). The USGS cooperates with its public and private collaborators to help them maintain necessary services, better understand the environmental consequences of their commercial and non-commercial activities, and to develop new products and services.

For more information please visit:
http://www.usgs.gov/tech-transfer/contacts.html

- **CRADA Underway to Control Invasive Aquatic Species in Great Lakes and Upper Mississippi**

The USGS Upper Midwest Environmental Science Center (UMESC) and Advanced BioNutrition Corp. (ABN) have entered into a traditional CRADA for the development of integrated delivery mechanisms to control aquatic invasive species and their pathogens. Today, there are over 180 invasive species that have been introduced into the Great Lakes and the Upper Mississippi River System. One new invasive species is added every 8 months. ABN is a U.S. company with proprietary technology in a product called MicroMatrix™, capable of delivering a broad range of biological and chemical products, including vaccines and probiotics, orally to specific aquatic species while minimizing harmful effects to other species. The USGS and ABN have negotiated a five year CRADA to research and develop methodologies to deliver a variety of bioactive compounds to control invasive organisms and their pathogens.

At the outset, their research will focus on the control of Asian carp including silver and bighead carp. Later, the parties plan to focus their research on tools to control zebra and quagga mussels, faucet snails or hosted trematode parasites, larval sea lamprey, and common carp. Their research will focus on the unique feeding strategies of these invasive species to target specific oral, mucosal or gastrointestinal sites for delivery to them of specific pathogenic compounds.

- **Innovative, Cost-Effective Well Profiling Technology**

In 2004, the USGS licensed two sister patents disclosing an apparatus and process to evaluate well bore water flow and obtain ground well water chemistry data. In brief, the inventions offered a way to sample well water and profile wells without removing large turbine pumps, a costly endeavor that, prior to the introduction of the USGS-patented technology, was the only way to obtain the needed data. These wells have limited access, e.g., clearances as small as 1 inch that can be exploited by applying the teachings of the patents without having to remove the pumps. Thus, sampling can take place much more easily and cheaply. Over the past four years, the licensee has successfully introduced this technology in several Western states and is growing the market by educating potential customers about the cost savings they may realize through its use.

Bureau of Reclamation

The Bureau of Reclamation (Reclamation) is responsible for water and hydropower deliveries for Reclamation projects throughout the 17 Western states. Reclamation manages several research programs that provide advanced solutions to a broad range of water and power management issues. The research results serve to improve Reclamation water management practices, increase water supply, and ensure cost-effective power generation operations to benefit Reclamation's stakeholders.

The Reclamation Research and Development (R&D) programs that participate in federal technology transfer legislative activities are the Science and Technology Program, the Colorado River Basin Salinity Control Program, and the Operations and Maintenance Program.

The broad scope of some of Reclamation research solutions can be viewed from the link: http://www.usbr.gov/research/science-and-tech/research/results/index.html

- **Cellulose Acetate Membrane**

In collaboration with Separation Systems Technology Inc. (SST), Reclamation researchers have developed new cellulose acetate membranes that perform better than existing cellulose acetate membranes by removing more salts at lower operating pressures. Reclamation's patented membrane manufacturing process incorporates a solvent processing step that is more effective at removing impurities than previous methods. Initial tests of new cellulose acetate membranes were conducted at SST, and testing of additional membranes is ongoing. Further long-term tests will be conducted at Reclamation's Water Quality Improvement Center in Yuma, AZ and/or its Brackish Groundwater National Desalinization Research Facility in Alamogordo, NM.

Currently, flat sheets of cellulose acetate membrane are being tested. The next step is to conduct testing on commercial reverse osmosis membrane prototypes. This 2" diameter by 40" long spiral-wound membranes will be tested under a range of water salt concentrations and operating pressures. Reclamation is currently seeking an industry partner(s) to cooperate in further testing and commercialization of these new cellulose membranes.

Department of Transportation (DOT)

The Department of Transportation (DOT) is the Federal steward of the nation's transportation system. DOT is made up of many transportation agencies and programs, all of which seek to apply innovations from the research and development (R&D) programs to fulfill the key goals of the Department: safety, mobility, global connectivity, environmental stewardship, security, and organizational excellence. Technology Transfer is carried out in all of laboratories in the Department. They include the Federal Aviation Administration's (FAA) William J. Hughes Technical Center, the Federal Highway Administration's (FHWA) Turner-Fairbank Highway Research Center, and the Research and Innovative Technology Administration's (RITA) Volpe National Transportation Systems Center (Volpe Center). Beginning in 2004 the Research and Innovative Technology Administration was charged with the coordination of technology transfer efforts across the Department.

For more information about the DOT technology transfer please visit:
FAA: http://faa.gov/about/office_org/headquarters_offices/ato/tc/initiatives/ttp
FHWA: http://www.fhwa.dot.gov
RITA: http://www.volpe.dot.gov/ourwork/techtrns.html

- **State-of-the-Art Vehicle Safety Systems**

The Volpe Center serves as the independent evaluator of the Integrated Vehicle-Based Safety Systems (IVBSS) project, the first large-scale initiative for both light vehicle and heavy truck platforms focused on safety system integration. IVBSS technologies warn

drivers in crash-imminent situations, helping to prevent rear-end, lane-change, and road-departure crashes.

IVBSS is a cooperative effort by an industry team led by the University of Michigan Transportation Research Institute and the U.S. DOT. The team includes the National Highway Traffic Safety Administration (NHTSA), the Federal Motor Carrier Safety Administration (FMCSA), and the Research and Innovative Technology Administration Intelligent Transportation Systems Joint Program Office (RITA JPO).

The IVBSS research initiative seeks to accelerate the introduction and commercialization of integrated vehicle-based crash warning systems for light vehicles and heavy trucks. The objective is to assess potential safety benefits and driver acceptance of the integrated safety systems. These integrated systems are expected to prevent conflicting warnings, reduce false alarms, enhance consumer and fleet operator acceptance, and boost product marketability.

The Volpe Center team worked closely with U.S. DOT and industry team members and provided expert input to the IVBSS program, including:

- IVBSS system design and functionality.
- Verification of test procedures for track and public road tests for cars and trucks.
- Test-track and public road verification testing of prototype IVBSS on both cars and trucks.
- Evaluation of verification test results.
- Recommended system performance enhancements prior to the field trials.

Based on test results, the project will proceed with large field operational tests (FOTs) of IVBSS-equipped light vehicles and heavy trucks in 2009.

The Volpe Center team prepared an independent evaluation plan for IVBSS based on data to be collected in the FOTs in 2009, developed data mining algorithms, and devised analytical techniques to forecast the safety benefits likely to accrue from widespread national IVBSS deployment.

- **Integrated Electronic Flight Data Interface (EFDI)**

Dr. Todd Truitt, an engineering research psychologist with the Federal Aviation Administration's (FAA) William J. Hughes Technical Center in Atlantic City, N.J., and member of the Human Factors and Ergonomics Society, has created "Concept Development and Design Description of Electronic Flight Data Interfaces for Airport Traffic Control Towers."

Dramatic projected increases in air traffic and focused modernization efforts have led the FAA to consider replacing paper flight progress strips with an electronic alternative. Electronic flight data (EFD) interfaces can potentially increase a controller's ability to acquire, track and record information, as well as communicate and coordinate that information with others. More importantly, EFD can improve controller efficiency by providing new methods of flight data management that integrates information into a single source, enhancing safety.

The first prototype interface, the Integrated EFDI, combines textual EFD with an airport surface situation display provided by Airport Surface Detection Equipment - Model X (ASDE-X) radar. The second prototype interface, the Perceptual-Spatial (P-S) EFDI, combines textual EFD with an airport surface map, without using ASDE-X radar. This interface also functions as a backup flight data management system to the Integrated EFDI if ASDE-X capabilities were to fail.

"We were excited to demonstrate the effectiveness of electronic flight data interfaces to such an influential target audience," said Deborah Germak, the FAA's Technology Transfer Program Manager. "This new design and technology has the potential to enhance the performance of air traffic controllers and the National Airspace System, overall."

- **The Next Generation Simulation Community Concept**

Transportation professionals use traffic simulation models to design, evaluate, and optimize existing and planned transportation facilities and systems. With today's congested and complex transportation facilities, it is critical that traffic simulation models be accurate and trustworthy so that sound transportation decisions can be made. To help address this issue, the Federal Highway Administration (FHWA), Turner-Fairbank Highway Research Center launched the Traffic Analysis Tools Program to develop new and improved analysis methods and facilitate deployment of existing tools. As part of this effort, FHWA sponsored the Next Generation Simulation (NGSIM) program to improve the quality of traffic simulation tools and promote the use of simulation research. The NGSIM program has had a significant impact on the traffic simulation community. One significant shift included a change in the role of FHWA within the community. Rather than continuing its traditional role developing, distributing, and supporting simulation tools as a *competitor* in the marketplace of traffic analysis tools, FHWA instead chose a new role of market *facilitator*.

The NGSIM trajectory data sets have been utilized by researchers world-wide in a variety of other research efforts outside the scope of the NGSIM program. In addition to providing valuable data sets, driver-behavior algorithms and some research funding, the NGSIM program has actively engaged traffic simulation vendors to accelerate the validation and implementation of these advanced and improved algorithms in the commercial models used across the nation. The NGSIM program has resulted in unprecedented collaboration between software developers, researchers, and software tool end-users. The end result is that almost five years after the inception of the NGSIM program, there is a critical mass of individuals composing an *NGSIM community* – a diverse and collaborative collection of academics, public sector staff, consultants and other analysts seeking to improve the underlying fidelity and accuracy of traffic simulation analysis.

Department of Veterans Affairs (VA)

The mission of VA's Technology Transfer Program (TTP) is to serve veterans and the American public by commercializing worthy discoveries made by VA employees in

furtherance of VA's research mission. This requires a program that educates inventors concerning their rights and obligations, rigorously evaluates all inventions, obtains patents, and assists in the commercialization of new products. It also requires consistent policies that govern the necessary relationships between investigator (i.e., inventor), academic partners, local VA medical centers, VHA-affiliated non-profit corporations, industry, and the Department of Commerce.

More information is available on the VA's Technology Transfer Program website: http://www.research.va.gov/programs/tech_transfer/default.cfm

- **Soft Suicide Prevention Door**

One of VA's licenses this year was The Soft Suicide Prevention Door (SSPD). This technology was invented as a result of the increased awareness to improve the physical safety of acute Mental Health Units and is non-exclusively licensed to Kennon Aircraft Covers. The SSPD was created by VA employees at the Sheridan, Wyoming VAMC specifically for acute psychiatric units. The design of the door is such that it provides privacy for the patient when using the bathroom or shower, yet does not provide the anchor points that a hard core door or shower curtain provides that are used for suicide. Recently, National Center for Patient Safety (NCPS), an arm of the VA, publicized information that stated 75% of inpatient suicides involved hanging. The VA continues to maintain a strong position as a leader in Suicide Prevention and the SSPD has great potential to help reduce suicides in VA and all other Mental Health facilities.

- **Genetic Basis of Alzheimer's Disease and Diagnosis and Treatment Thereof**

This invention describes genetic variations (polymorphisms) which, in combination, predict risk for Alzheimer's disease. The invention is exclusively licensed to Perlegen Sciences, Inc. This invention can be used for predictive testing for drug trials to determine if specific groups respond preferentially to a drug and for the diagnosis of subjects in a drug trial. The genetic profile of these specific polymorphisms can be used to diagnose Alzheimer's disease. The invention can help to develop genetic markers that may be useful for stratifying and predicting susceptibility to Alzheimer's. It is anticipated that the diagnostic will be offered broadly in the market with the potential for preventing or delaying the onset of Alzheimer's disease.

Environmental Protection Agency (EPA)

EPA's Federal Technology Transfer Act (FTTA) Program was established to promote collaboration between private and federal research. EPA offers exceptional opportunities to develop and commercialize new technologies. Through the authority given to EPA by the Federal Technology Transfer Act, EPA facilitates the transfer of new technologies to the marketplace while protecting intellectual property rights of all parties.

Partners in the FTTA Program will 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 the environmental technologies into the marketplace more quickly, resulting in better protection of human health and the environment.

Highlights of several outcomes of the Agency's technology transfer activities are provided below. For more information please visit: http://www.epa.gov/osp/ftta.htm

- **A New Age for Vehicle Inspection and Maintenance:**

Development of Portable, Plug-and-Plan Device Technology for On-Board Diagnostic Based Inspection and Maintenance Programs

The second generation of On-Board Diagnostic (OBD) Technology has been required by the United States Environmental Protection Agency (EPA) on Light-Duty Vehicles and Trucks (LDV/Ts) since the 1996 model year (MY) vehicles. OBD is designed to monitor, detect and indicate faults in critical emission control components/systems and emission-related components.

Inspection and Maintenance (I/M) Programs are currently present in 36 states in the U.S.A., the British Columbia and Ontario Provinces in Canada, and in several European Union countries. As a result of increasingly stringent emission standards, OBD has been implemented in existing I/M Programs to replace traditional, tailpipe emission measurement equipment. This paradigm shift represents an opportunity to streamline I/M Programs further by conducting remote vehicle inspections of OBD-equipped vehicles. To support our I/M stakeholders, the EPA's Office of Transportation and Air Quality (OTAQ) examined the possible methods of performing remote vehicle inspections: cellular- or satellite-based, long-range data transmission; wireless, short-range data transmission; and portable, plug-and-play device. Based on this examination, the EPA-OTAQ determined that the plug-and-play device option needed to be further examined since other options have previously been or are being explored and due to privacy concerns associated with other methods.

As a result, the EPA-OTAQ's National Vehicle Fuel Emissions Laboratory (NVFEL) collaborated with Davis Instruments, Inc., a U.S. company based out of Hayward, California to develop a portable, plug-and-play OBD device. Based on Davis Instruments' Carchip, OBD-compatible flight recorder, EPA and Davis Instruments created the Carchip Green designed to retrieve and transfer OBD I/M parameters needed to perform remote OBD I/M vehicle inspections.

The Carchip Green connects to the standardized OBD connector on all OBD-equipped vehicles and collects the status checks (i.e., readiness status), the condition (i.e., pass or fail), and the presence of fault codes for the monitored emission control components/systems. The Carchip Green can be connected to a desktop or laptop computer with resident Carchip software to retrieve, format, store and transmit the OBD I/M related data. Several possible scenarios for integrating the CarChip Green into existing OBD I/M Programs include:

- Point-to-Point Delivery (State→vehicle owner→State→owner notification);
- Third-Party Distribution (vehicle owner→gas station, motor club, mall, etc. →State→Owner notification); and/or

- Wireless Access Point using Carchip Green with wireless capability (vehicle owner→wireless kiosk, gas pump, electronic toll, road-side receiver, etc., →State→owner notification)

The Carchip Green will significantly enhance OBD I/M programs by reducing administrative costs while increasing public convenience, fleet coverage, and acceptance of OBD I/M Programs by reducing administrative costs while increasing public convenience, fleet coverage, and acceptance of OBD I/M Programs and remote vehicle inspections.

- **Enhancing Medical Research**

Advancements in Electromagnetic Therapy

Research often has unexpected and far-reaching benefits. This method to enhance tissue growth was an outcome from EPA's research into the health effects of chemicals introduced into drinking water by the disinfection process (disinfection byproducts). EPA research focused on the underlying molecular targets responsible for cancer induction in animal models. EPA scientists designed and conducted a series of tests of disinfection by-products and closely related chemicals that revealed different concentration response curves but otherwise exhibited no additional characteristics upon which to develop a mode of action (MoA). The principal investigator decided to use magnetic fields and melatonin, which had been shown to enhance the tumor-suppressor function, as tools to reveal underlying characteristics that would aid in the development of a MoA. Results with both tools allowed for segregation of the chemicals into otherwise indistinguishable subgroups. The investigator, aware of activities in other research areas where these tools were beginning to be used, inadvertently discovered treatment conditions that allowed for more refined and precise methods and applications for healing bones and enhancing tissue growth in human and animal models.

This patented methodology describes how to preferentially stimulate certain ions within tissues or cells. Clinical and animal research has shown that ionic stimulation by magnetic fields has increased the rate of cellular activity or bone growth in broken or damaged bones. In some cases, ionic stimulation has improved or increased the total amount of bone density. The methodology also has application in nervous system processes including nerve growth. Based on these features, researchers at Indiana University Medical School established a cooperative research and development agreement (CRADA) with the EPA to determine whether immunological cells can be altered by the patented methodology to ameliorate disease states or make normal cellular immunity more robust.

National Aeronautics and Space Administration (NASA)

Since its creation in 1958, NASA has been charged with disseminating the results of its research broadly for public benefit. The organization responsible for technology transfer within NASA is the Innovative Partnerships Program (IPP). With offices at HQ and all ten of NASA's field centers, IPP seeks to develop technology to meet NASA's needs through partnerships with industry, academia, government agencies, and national

laboratories, and facilitates intellectual property protection and transfer out of NASA developed technology for commercial application and broad public benefit. IPP also works through its center offices to foster collaboration with state and local governments involved in public benefit and local economic growth through technology development and technology transfer.

Each year, NASA documents some notable successes from technology transfer efforts in the annual Spinoff publication. It is available online at http://www.sti.nasa.gov/spinoff, and hard copies are available upon request. More than 1,600 spinoff successes have been documented in the publication and are all searchable by keyword on the website. In addition, NASA has established a website called NASA@Home, NASA City, located at http://www.nasa.gov/city which helps the public understand how NASA technologies are present in and contributing to the quality and safety of their everyday life. NASA is also participating, along with several other federal agencies, in using RSS feeds to highlight technologies available for licensing to the commercial and research communities; details are made available on the IPP web site.

More information about the NASA Innovative Partnership Program can be found at: http://www.ipp.nasa.gov; http://www.sti.nasa.gov/spinoff; http://www.nasa.gov/city

- **Treatment Prevents Corrosion in Steel and Concrete Structures**

To protect concrete launch structures at Kennedy Space Center from corrosion, NASA developed an electromigration technique that sends corrosion-inhibiting ions into rebar to prevent rust, corrosion, and separation from the surrounding concrete. Kennedy worked with Surtreat Holding LLC, of Pittsburgh, Pennsylvania, a company that had developed a chemical option to fight structural corrosion, combining Surtreat's TPS-II anti-corrosive solution and electromigration. Kennedy's materials scientists reviewed the applicability of the chemical treatment to the electromigration process and determined that it was an effective and environmentally friendly match.

NASA has also developed a new technology that will further advance these efforts-a liquid galvanic coating applied to the outer surface of reinforced concrete to protect the embedded rebar from corrosion. Surtreat licensed this new coating technology and put it to use at the U.S. Army Naha Port, in Okinawa, Japan. The new coating prevents corrosion of steel in concrete in several applications, including highway and bridge infrastructures, piers and docks, concrete balconies and ceilings, parking garages, cooling towers, and pipelines. A natural complement to the new coating, Surtreat's Total Performance System provides diagnostic testing and site analysis to identify the scope of problems for each project, manufactures and prescribes site-specific solutions, controls material application, and verifies performance through follow-up testing and analysis.

- **NASA Technology Protects Deep-Sea Divers**

Paragon Space Development Corporation is a woman-owned small business, specializing in aerospace engineering and technology development, and is a major supplier of environmental control and life support system and subsystem design for the aerospace industry. Paragon has proven itself expert in thermal control for spacecraft in orbit and

during reentry, as well as for hypervelocity aircraft. In recent years, Paragon has worked on several different projects that benefit NASA and the space community. Through a NASA-funded Small Business Innovation Research (SBIR) contract, Paragon utilized its unique thermal analysis and structural design capabilities to develop a new, reduced-weight radiator system for use on space vehicles designed to transport crew. Paragon's extensive experience providing life support in extreme environments assisted in the development of a line of such products to protect Navy divers against hazardous materials; in particular, the successful design of a diving suit that now also has the potential for use in commercial diving. In designing the suit, Paragon applied its understanding of air flow in a space suit helmet, use of an umbilical to support an astronaut during a space walk, cooling undergarment systems to remove excess body heat, computer codes for thermal and airflow analysis, and materials that have been developed for the aerospace industry that are resistant to extreme chemical and temperature environments.

- **Aerogels Insulate Missions and Consumer Products**

Aspen Aerogels, of Northborough, Massachusetts, an independent company spun off from Aspen Systems Inc., rose to the challenge of creating a robust, flexible form of aerogel by working with NASA through a Small Business Innovation Research (SBIR) contract with Kennedy Space Center. That contract led to further partnerships for the development of thermal insulation materials, manufacturing processes, and new test methods.

Aspen responded to NASA's need for a flexible, durable, easy-to-use aerogel system for cryogenic insulation for space shuttle launch applications. For NASA, the final product of this low thermal conductivity system was useful in applications such as launch vehicles, space shuttle upgrades, interplanetary propulsion, and life support equipment. The company has since used the same manufacturing process developed under the SBIR to expand its product offerings into the more commercial realms, making aerogel available for the first time as a material that can be handled and installed just like standard insulation.

Conclusion

Technology transfer is an active and essential mission of Federal 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 cultivated in the Federal sector. The statistical data provided in this report indicate that over the five-year span of 2004 through 2008, licenses, income bearing licenses, income from licenses, and earned royalty income trended upward. The total number of patent applications by internal research programs in the eleven agencies rose between fiscal year 2004 and 2008 to 1,938, an increase of 9.6 percent. The number of licenses jumped to 11,098 from fiscal year 2004 to 2008, an increase of 46.6 percent, and the number of income bearing licenses increased to 6444, a 35 percent rise. Federal revenues from these licenses grew from fiscal year 2004 through fiscal year 2008 to $170.9 million, a 71.7 percent jump and total earned royalty income reached $117.6 million, a 121.5% gain.

The success stories in this report provide 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 and in supporting our economy and our international competitiveness by successfully transferring and facilitating commercialization of Federally created technologies.