U.S. Department
of Transportation

**Research and
Innovative Technology
Administration**

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TO: **Don Archer, Technology Partnerships Office, National Institute of Standards and Technology**

FROM: **Dr. Kevin Womack, Associate Administrator for Research, Development, and Technology**

SUBJECT: **U.S. DOT's Technology Transfer (T2) Report for FY2011**

Every year, the Department of Commerce (DOC) submits a Federal Laboratory T2 Fiscal Year Summary Report to the President and the Congress in accordance with 15 USC Sec 3710(g)(2) summarizing the implementation of technology transfer authorities established by the Technology Transfer Commercialization Act of 2000 (P.L. 106-404) and similar legislation. This report summarizes U.S. DOT's information for DOC's Fiscal Year 2011 Summary Report.

Please submit questions pertaining to this report to Santiago Navarro at santiago.navarro@dot.gov or 202-366-0849.

Attachment

cc:
Department of Commerce
National Institute of Technology and Standards

U.S. Department of Transportation

Technology Transfer – FY 2011

Research and Innovative Technology Administration's Office of Research, Development, and Technology

7/23/2012

Introduction

The U.S. Department of Transportation (DOT) is the federal steward of the nation's transportation system. DOT consists of multiple modal Operating Administrations, which carry out mission-related Research, Development and Technology (RD&T) programs in support of the DOT strategic goals: Safety, Livable Communities, State of Good Repair, Economic Competitiveness, and Environmental Sustainability. In 2004, the Research and Innovative Technology Administration (RITA) was charged by its enabling legislation[1] with coordination of DOT-wide RD&T and technology transfer activities.

DOT defines technology transfer as the process of transferring and disseminating transportation related scientific information to stakeholders who may apply it for public or private use. DOT's current approach to technology transfer is diverse and unique to each mode of transportation. Each modal Operating Administration conducts misson specific deployment activities tailored to its mode and type of research.

Technology Transfer activities are executed by the following DOT laboratories:

Federal Aviation Administration's (FAA): The FAA's Federal laboratory is the William J. Hughes Technical Center located at the Atlantic City International Airport, New Jersey.

Federal Highway Administration's (FHWA): Turner-Fairbank Highway Research Center (McLean, VA).

Research and Innovative Technology Administration's (RITA): John A. Volpe National Transportation Systems Center (Volpe Center, Cambridge, MA).

1. Early Win for NextGen in 2011: Leaner, Greener Aircraft Arrivals

Source: Volpe Highlights, March/April 2-11

San Francisco (SFO), Los Angeles (LAX) and Miami (MIA) International Airports report fuel savings and emissions reductions after three years of testing oceanic Tailored Arrivals (TA), a project that supports the Federal Aviation Administration (FAA) Next Generation Air Transportation System (NextGen) program and includes the U.S. Department of Transportation's Volpe Center, air traffic control facilities, NASA, airlines and aircraft manufacturers. In an oceanic tailored arrival situation, a properly–equipped aircraft approaching a coastal destination from the ocean follows a path that optimizes fuel use during its descent. TA trials at SFO demonstrated significant benefits including reduced controller and pilot workload by decreasing the number of discrete arrival clearances and radio transmissions; decreased noise, fuel burn and emissions by flying at near-idle thrust engine settings during descent; improved overall efficiency; and predictability of flight paths.

[1] P.L 108-426, November 30, 2004 (118 STAT. 2423).

Figure 1 Airbus 380 aircraft descending into SFO Airport. ***(Volpe Center photo)***

The FAA Office of NextGen Operations Planning led this collaborative project with the active participation and support of RITA's Volpe Center NextGen team. Volpe supported the TA test phase by providing project management assistance, analyzing emissions data, developing standard operational and measurement procedures, and accelerating procedural documentation of the trials. For example, Volpe Center aviation measurement experts quantified fuel savings from the TA trials at MIA that demonstrate worthwhile fuel and emissions savings with the new oceanic TA operations, as compared to standard approaches.

With the completion of the flight trial phase, the FAA Air Traffic Organization's En Route and Oceanic Services (ATO-E) took over the management of the TA project. These results have provided an "early win" for NextGen by pointing to future success in advancing economic and environmental benefits as ATO-E replicates the successful trials at other U.S. airports and Air Force Bases.

2. The Volpe Center Enhances Rail Passenger Equipment Crashworthiness and Occupant Protection

Protecting passengers in the event of a collision or derailment is an ongoing area of investment for the FRA. The FRA relies on Volpe engineers to improve its understanding of the factors involved with passenger protection and impact absorption, focusing on the type of structural modifications that can prevent rail cars from crushing. Volpe engineers have investigated many severe passenger-train accidents; staged impact tests; analyzed car-crush zones; and studied train and occupant dynamics to improve accident survivability. Volpe Center crashworthiness research is being applied to FRA regulations and new industry standards.

Figure 2 Volpe crashworthiness experts investigated the lead locomotive of the Chatsworth, CA rail accident *(Volpe Center Photo)*

The Center has developed modeling tools and passenger rail equipment design strategies with improved crashworthiness over existing designs. Research results were used to develop and support the FRA locomotive and passenger equipment safety standards. Volpe technical studies on crashworthiness are widely disseminated and shared with the rail industry, and the application of the study results in safer designs and new standards development. Through the American Public Transportation Association (APTA) and the American Association of Railroads (AAR), the railroads and their equipment suppliers are involved in planning and conducting these studies, to ensure technology transfer. Results were presented to stakeholders at the 2011 Joint Rail Conference (JRC), where Volpe experts organized and chaired sessions. Findings were documented and disseminated in FRA/Volpe reports and in technical papers for the American Society of Mechanical Engineers (ASME,) the Transportation Research Board (TRB) and APTA.

Figure 3 A new Los Angeles Metrolink cab car using the safer Volpe Center design for improved passenger protection in crashes.

3. FHWA: Sidewalks That Don't Trip You Up

Pavement smoothness is not only vital to building better roadways but a key factor in ensuring that sidewalks and curb ramps are accessible to individuals with disabilities and meet the standards of the Americans with Disabilities Act (ADA). However, the traditional ADA survey process for assessing the condition of sidewalks and curb ramps is time-consuming and does not offer jurisdictions precise data. The Ultra-Light Inertial Profiler (ULIP), an instrumented Segway® developed by FHWA for pavement surface evaluation, offers an accurate and cost-effective solution. FHWA provided technical support as Bellevue, Washington, used the ULIP to conduct an ADA evaluation of existing physical barriers for persons with disabilities. Use of the technology cut Bellevue's costs from more than $1 million to $285,000 and resulted in more precise data on conditions such as pavement roughness and defects, helping the city to better prioritize its remediation efforts. The cities of San Marcos, Clovis, and San Carlos in California are also using the ULIP for ADA assessment in 2011.

Figure 4 Sally Swanson Architects, Inc., used the Ultra-Light Inertial Profiler-ADA (ULIP-ADA™ to conduct an Americans with Disabilities Act (ADA) evaluation of sidewalk running grade, cross slope, and change in level for the City of Clovis, California.

4. FHWA Improving Highway Operations

Targeted Safety Messages Talk to Your Vehicle

Operations research that will use the Cooperative Vehicle-Highway Test bed (CVHT) in FHWA's new Transportation Operations Laboratory includes the Signal Phase and Timing (SPaT) Interface Definition and Prototype, which will define a common two-way interface between vehicle systems, mobile devices, and traffic signal controllers. This would enable applications such as warning drivers they are about to violate a red light and optimizing traffic flows through intersections, which can reduce emissions and fuel usage. The first two prototype controllers to use this new interface will be tested in the CVHT in late 2011 and early 2012.

FHWA is also supporting the procurement of roadside equipment that will enable wireless communications between vehicles and infrastructure for the Connected Vehicle Safety Pilot, which is being led by the Intelligent Transportation Systems (ITS) Joint Program Office of the U.S. Department of Transportation's (U.S. DOT) Research and

Innovative Technology Administration. Beginning in 2011 and running through the first half of 2013, this major research initiative will test how drivers in real-world conditions will respond to wireless safety messages targeted to them based on their specific position, situation, or vehicle type. These messages could include warnings such as "Use Caution, Icy Roads Ahead" or "Stop! Red Light Ahead" and address crashes associated with driving too fast for the conditions or driver distraction.

Traffic Signal Triggers

FHWA researchers are using step-frequency ground-penetrating radar (SF-GPR) to develop a nondestructive method for detecting and assessing inductive loop sensors that are embedded in roadway surfaces. The SF-GPR technology offers advanced subsurface three-dimensional imaging capabilities. The sensors being assessed indicate the presence or movement of vehicles and provide information that supports such traffic management applications as signal control and freeway mainline roadway and ramp control. Malfunctioning sensors can prevent traffic signals from sensing the presence of vehicles, which can be both frustrating for drivers and delay or prevent the display of green signal indicators to motorcyclists and bicyclists. Since research began in 2006 under a Small Business Innovation Research project, FHWA has improved the GPR detection and resolution capability and made significant steps in advancing the technology to the point where it can be commercialized.

Figure 5 Among the concepts being developed at FHWA's Transportation Operations Laboratory is connected vehicle technology, which can reduce delays and the number of crashes that occur during stop-and-go traffic.

5. FHWA Improving Highway Operations

A New World of Ultra-High Performance Concrete

As the Nation looks to build longer lasting bridges and more rapidly renew its highway infrastructure, the use of high-strength and high-performing materials is more important than ever. For more than 10 years, FHWA's structural concrete R&D program has

worked to take concrete to new levels with the implementation of ultra-high performance concrete (UHPC). Exhibiting superior properties such as exceptional durability, high compressive strength, and long-term stability, UHPC components can facilitate accelerated construction and allow for the use of longer spans. States such as Iowa, New York, and Virginia are now beginning to use the new technology. In Buchanan County, Iowa, for example, the construction of the Jakway Park Bridge received a boost with the successful use of a new type of UHPC bridge girder developed through the FHWA R&T program. This was the first bridge in the country to be built using the UHPC technology, demonstrating the viability of the concept from design, through construction, and into everyday use.

UHPC research focal areas are advancing, including through a Transportation Pooled Fund project being conducted in partnership with the New York State Department of Transportation (NYSDOT) and the Iowa Department of Transportation. The project is evaluating the performance of novel field-cast UHPC connections linking prefabricated bridge girders to precast concrete bridge decks. While the use of modular bridge deck components can produce higher quality, more durable bridge decks, the required connections have often been lacking, diminishing the overall system performance. The new UHPC connection eliminates the conflict points between the deck reinforcing bars and the girder shear connectors, allowing for easy field assembly. NYSDOT hopes to use the concept in a highway interchange reconstruction project in 2011.

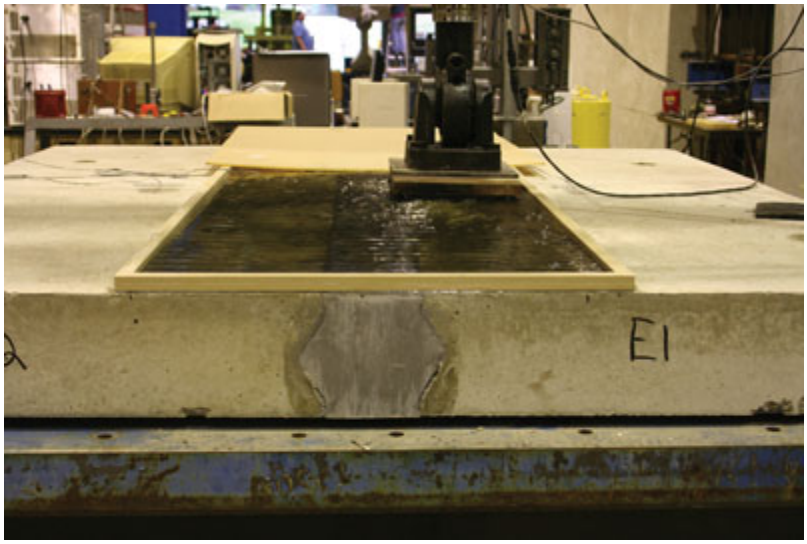

Figure 6 Ultra-high performance concrete connections are tested at FHWA's Turner-Fairbank Highway Research Center. These connections can link prefabricated bridge girders to precast concrete bridge decks.

Figure 7 Ultra-high performance concrete pi-girders were used in the construction of the Jakway Park Bridge in Buchanan County, Iowa.

6. The National Park Service Releases Volpe Environmental Impact Statement (EIS) to Address Aircraft Noise Impacts for Grand Canyon National Park

Source: http://newslink.federallabs.org/2011/06/15/environmental-impact-statement-released-by-national-park-service/

In February 2011, the National Park Service (NPS) released the Draft EIS, *Special Flight Rules Area in the Vicinity of Grand Canyon National Park*. It was developed to support the mandate of the 1987 National Parks Overflights Act, namely to address the substantial restoration of natural quiet and reduce the impacts of aircraft noise on park resources and on visitor experience in the vicinity of Grand Canyon National Park. "Substantial restoration of natural quiet in Grand Canyon National Park" is achieved when reduction of noise due to aircraft operations at or below 18,000 feet mean sea level (MSL) results in 50% or more of the park area achieving natural quiet (i.e., no aircraft audible) for 75% to 100% of the day, each and every day.

The Environmental Measurement and Modeling Division at the Volpe Center - a part of the U.S. Department of Transportation's Research and Innovative Technology Administration (RITA) - supported the Draft EIS with a comprehensive noise analysis of four alternatives: Alternative A, continued current management (the No Action Alternative), and three action alternatives – including the NPS Preferred Alternative. The noise analysis was performed using the Federal Aviation Administration's (FAA) Integrated Noise Model (INM) version 6.2a, which is developed and maintained by the Volpe Center. This model was recommended by the Federal Interagency Committee on Aviation Noise (FICAN) as the best practice modeling methodology currently available for evaluating aircraft noise in National Parks, and agreed to by NPS and FAA after

extensive studies comparing the models currently available and upgrades to the previous version of INM. The Volpe Center team continues to support the FAA and NPS efforts to preserve environmental quality at National Parks across the nation.

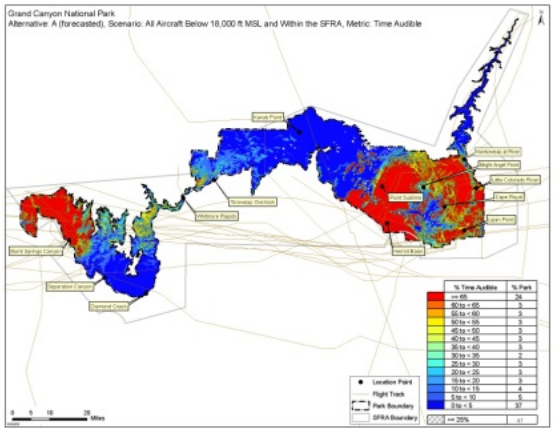

Figure 8 **No Action Alternative (10-Year Forecasted Peak Season) – % Time Audible Contours for All Aircraft Below 18,000 ft MSL and Within the SFRA.** ***(Volpe Center graphic)***

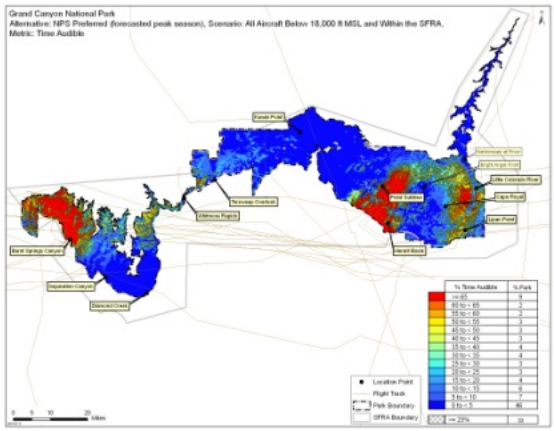

Figure 9 **NPS Preferred Alternative (10-Year Forecasted Peak Season) – % Time Audible Contours for All Aircraft Below 18,000 ft MSL and Within the SFRA.** ***(Volpe Center graphic)***

7. Volpe Center Modeling Tool Helps FAA Ease Airport Congestion

Source: Volpe Highlights, October 2011

Boarding an airplane, pushing back from the gate and then getting caught in a long departure queue on the runway is a common and annoying aspect of air travel. The FAA has invested heavily in tools and technologies to address congestion of the airspace, and now is examining how to reduce congestion on the airport surface.

Figure 10 The FAA is examining how to reduce congestion on the airport surface. ***(FAA photo)***

RITA's Volpe Center is applying operations research techniques to support the FAA's Collaborative Departure Queue Management initiative (CDQM). CDQM is one of many technologies under development as part of the Next Generation Air Transportation System (NextGen). The Federal Aviation Administration (FAA) has invested heavily in tools and technologies to address congestion of the airspace, and now is examining how to reduce congestion on the airport surface, with Volpe Center technical support.

Easing congestion on the airport surface potentially improves the level of customer satisfaction and significantly cuts down on the amount of fuel burned during taxi operations. An added benefit is a reduction in greenhouse gas emissions.

As part of the CDQM prototype evaluation at the Memphis, TN, airport, flight schedules and air capacity data are shared between flight operators (e.g., airlines) and air traffic control. Sophisticated algorithms are used to assess real-time surface capacity and provide flight operators recommendations on when aircraft can push back and begin taxi-out procedures to minimize wait times. In some cases, aircraft may push back from the gate and sit in a virtual queue without starting their engines, and then begin the taxi-out procedure only when the actual departure runway queue is short. Volpe Center's Aviation Systems Engineering Division has developed a modeling and simulation tool being used by the FAA to assess the applicability and likely benefits of implementing CDQM in other airports. The data from the modeling and simulation tool, along with results of the Memphis CDQM evaluation, will provide key insight into the effectiveness of CDQM as an airport congestion management system. In other cases, passengers may be held in the terminal and begin boarding only when surface capacity has opened up sufficiently to allow for departure. The FAA estimated that when fully implemented at

the Memphis airport, CDQM can potentially reduce taxi-out time by 5000 hours per year, resulting in savings of thousands of gallons of fuel.

8. Volpe Assessments of Pavements for Highway Traffic Noise Reduction

Source: Volpe success story published in the *"FLC State and Local Governments: Partners for Technology Transfer Success"* on p. 9 at http://www.federallabs.org/store/sandlg-2011/

Due to the U.S. Department of Transportation's Research and Innovative Technology Administration Volpe National Transportation Systems Center's (Volpe Center) expertise in tire-pavement noise issues and highway traffic noise prediction, two state transportation agencies asked the Volpe Center in 2011 to help assess various pavement types in terms of vehicle and highway traffic noise levels. Excessive levels of highway traffic noise affect people in houses, schools, parks, offices, and other facilities in the vicinity of the highways. Transportation agencies typically construct noise barriers to help reduce highway traffic noise, and they are looking for additional noise reduction strategies.

The Arizona Department of Transportation (ADOT) asked the Volpe Center to conduct two studies: The first study examined three different safety surface treatments for Portland Cement Concrete (PCC) and ranked these in terms of noise. The outcome resulted in a change of standard practice in Arizona to the quietest of the three surface treatments. The second study was part of the Quiet Pavement Pilot Program (QPPP), a partnering research program of the Federal Highway Administration (FHWA) and ADOT, and is examining the noise reducing benefit of rubberized asphalt over time. The QPPP allows ADOT to account for the benefits of quieter pavement in noise impact analyses and barrier designs.

The California Department of Transportation (Caltrans) also asked the Volpe Center to help conduct two studies. The first study examined various safety surface treatments for Portland Cement Concrete (PCC) and ranked these in terms of noise. The second study examined noise associated with five asphalt pavement formulations. The noise reduction benefit of each pavement was investigated in terms of pavement age, pavement composition, and vehicle type. Ultimately, this study will contribute to recommended pavement use throughout the state. These Volpe Center studies and noise measurement protocols will influence standard practice of pavement choice for highway projects, as well as the national FHWA policy on accounting for the effects of pavements in highway traffic noise impact prediction and analysis.

Figure 11 Volpe Center team is shown measuring highway noise (Volpe Center photo).

9. Volpe Center Supports New Tools for Regional Transportation Planning

Source: Volpe Center Highlights March/April 2011

Over the past four years, RITA's Volpe Center has supported the Federal Highway Administration's efforts to accelerate deployment of the Transportation Analysis and Simulation System (TRANSIMS). TRANSIMS is an open-source transportation planning model intended for regional use which provides several capabilities beyond those of traditional planning models, including the use of either tours or trips, a very fine grained time-of-day detail, and the ability to perform traffic simulation over a region. Volpe Center staff support the TRANSIMS online community, participate in peer reviews and provide oversight over several TRANSIMS projects.

One significant milestone was reached in 2011 with the completion of the Moreno Valley TRANSIMS project. Moreno Valley is located approximately 50 miles east of Los Angeles, near Riverside. This project, with work primarily done by city personnel, used TRANSIMS to examine regional economic development and freight issues. Accomplishments included:

- Use of parallel processing to route the Southern California Association of Governments (SCAG) network under both current and future (2035) conditions; some 48 million daily trips are projected in the year 2035
- Micro-simulation of approximately two million projected daily trips over a substantial area, i.e., the city of Moreno Valley and environs
- Achieving results quality comparable to that from the current planning model

The work involved significant collaboration, with local agencies such as the Southern California Association of Governments and Riverside County, as well as the

Transportation Analysis and Computing Center (TRACC) of Argonne National Labs. The TRACC cluster provided the computing capability to run the SCAG network (one of the largest regional planning networks in the Nation), and their personnel provided initial training to Moreno Valley on TRANSIMS.

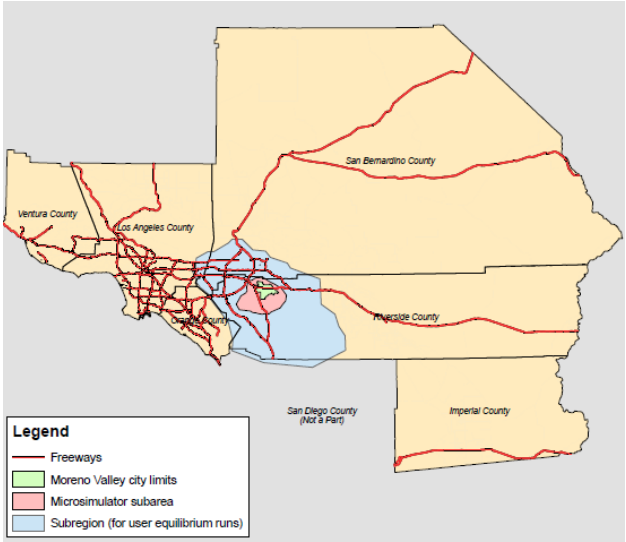

Figure 12 Southern California Planning Area

10. FAA's William Hughes Technical Center strengthens relationships with partners

The Federal Laboratory was instrumental in proving DOD requirement specifications for remote area lighting, and was in the critical path to commercialization. The completed unit (ground mounting, solar panel, wind turbine, rechargeable battery and LED lamps) has been commercialized and is being marketed and sold.
Partnerships were developed for the following:

Exploration of the application of real-time Air Traffic Control (ATC) simulation within a functional Magnetic Resonance Imaging (fMRI) environment. The collaboration may lead to use of a simulator to evaluate brain activity of controllers under a variety of ATC conditions.

Researching the feasibility of using the Versatile Onboard Traffic Embedded Roaming Sensors (VOTERS) technology to measure surface and subsurface conditions of runway pavement from a moving vehicle equipped with electronic remote sensing technology.

Other partnerships included the evaluation of full-scale engine performance for an unleaded fuel to determine its suitability as a potential to replace 100LL aviation gasoline; assessment of braking action results and variations with respect to runway contaminants, and error evaluation of a data acquisition system by simplifying the impact of ambient conditions; determined whether anti-icing behaviors observed on aircraft models correspond with behaviors on full scale transport aircraft.

11. FHWA Improving Highway Operations

The FHWA Office of Operations provides national leadership for the management and operation of the surface transportation system, including the areas of congestion management, ITS deployment, traffic operations, emergency management, and freight management and operations. Initiatives include the Localized Bottleneck Reduction Program, which examines the root causes, impacts, and potential solutions to traffic chokepoints that are recurring events. As part of this initiative, the office issued An Agency Guide on How to Establish Localized Congestion Mitigation Programs in 2011.

The FHWA Office of Planning, Environment, and Realty provides leadership in the areas of comprehensive intermodal and multimodal transportation planning, environmental protection and enhancement, and the fair and prudent acquisition and management of real property. Recent initiatives include the development of a 2011 Transportation Planning for Sustainability Guidebook, which examines how sustainability considerations can be better incorporated into transportation planning. The guidebook features case studies highlighting sustainability planning practices at State DOTs.

Table 1 DOT Technology Transfer summary on: CRADAs, inventions, patents, and other

Table	Description	*Fiscal Year*				
		2007	2008	2009	2010	2011
A	**Collaborative Relationships for Research and Development**					
	• CRADAs, total active in the FY	36	23	22	22	25
	- New, executed in the FY	7	6	7	0	8
	▪ Traditional CRADAs, total active in the FY	36	23	0	0	0
	▪ Non Traditional CRADAs, total active in FY	0	0	0	0	0
	▪ Other collaborative R&D relationships	0	0	2	2	5
B	**Invention Disclosure and Patenting**					
	• New inventions disclosed in the FY	2	3	3	1	2
	• Patent applications filed in the FY	2	0	1	1	1
	• Patents issued in the FY	3	2	1	1	0
C	**Profile of Active Licenses**					
	• All licenses, number total active in the FY	5	5	2	3	3
	▫ New, executed in the FY	0	0	0	0	1
	▪ Invention licenses, total active in the FY	1	5	3	3	3
	▫ New, executed in the FY	0	0	0	0	0
	▪ Other IP licenses, total active in the FY	0	0	0	0	2
D	**Characteristics of licensing bearing Income**					
	• All income bearing licenses, number	4	4	3	3	3
	▫ Exclusive	2	1	3	3	2
E	**Income from Licensing (thousands)**					
	• Total income, all licenses active in FY	$34	$18	$44	$17	15
	▪ Invention licenses	$34	$18	$44	$17	15
	▪ Other IP licenses, total active in the FY	$0	$0	$0	$0	0
	• Total Earned Royalty Income, (ERI)	$34	$9	$34	$3	5