U.S. Department
of Transportation

1200 New Jersey Ave, S.E.
Washington, D.C. 20590

**Office of the Assistant Secretary
for Research and Technology**

TO: **Dr. Michael Walsh, Technology Partnerships Office, National Institute of Standards and Technology**

FROM: **Dr. Kevin Womack, OST-R**

SUBJECT: **U.S. DOT's Technology Transfer (T2) Report for FY2013**

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 2013 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 2013

Office of the Assistant Secretary for Research and Technology

1/31/2014

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. In the Omnibus Bill of 2014, RITA was elevated to the Office of the Secretary and given a new name – the Office of the Assistant Secretary for Research and Technology.

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 mission specific deployment activities tailored to its mode and type of research. Agency specific technology transfer plans may be found here.

Technology Transfer activities are executed by DOT agencies and laboratories:

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

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

Office of the Assistant Secretary for Research and Technology (OST-R): John A. Volpe National Transportation Systems Center (Volpe Center, Cambridge, MA).

National Highway Traffic Safety Administration (NHTSA): Vehicle Research and Test Center (VRTC)

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

Table 1 Invention Disclosures and Patents

		FY09	FY10	FY11	FY12	FY13
	Invention Disclosure					
1	Number of new inventions disclosed	3	1	2	2	13
	Patents					
2	Number of patent applications filed	2	2	2	1	5
3	Number of patents received	1	2	0	0	1
Enter “0” to report that the agency did not use this mechanism in the reported year. Enter "N/A" to report that data is not available at time of report. Add rows and interpretive notes as needed.						

Table 2 Income Bearing Licenses

		FY09	FY10	FY11	FY12	FY13
	Income Bearing Licenses					
4	Number of income bearing licenses	3	3	3	3	3
5	Exclusive licenses	3	3	2	2	2
6	Partially exclusive licenses	0	0	0	0	0
7	Non-exclusive licenses	0	0	0	0	1
	Elapsed Amount time to Grant Licenses					
8	Data for rows 8-10 is not available.	N/A	N/A	N/A	N/A	N/A
Enter “0” to report that the agency did not use this mechanism in the reported year. Enter "N/A" to report that data is not available at time of report. Add rows and interpretive notes as needed.						

Table 3 Licensing Income

		FY09	FY10	FY11	FY12	FY13
	Earned Royalty Income					
11	Data for rows 11-16 is not available.	N/A	N/A	N/A	N/A	N/A
	Disposition of Earned Royalty Income (thousands)					
17	Total amount of Earned Royalty Income received	$34	$3	$8	$6	$0
18	Data for rows 17-20 is not available at the time of the report	N/A	N/A	N/A	N/A	N/A
Enter “0” to report that the agency did not use this mechanism in the reported year. Enter "N/A" to report that data is not available at time of report. Add rows and interpretive notes as needed.						

Table 4 Cooperative Research and Development Agreements

		FY09	FY10	FY11	FY12	FY13
	CRADAs					
21	Number of Active CRADAs	22	22	25	27	39
22	Number of newly executed CRADAs	7	0	8	1	7
23	Data for rows 23-24 is not available.	N/A	N/A	N/A	N/A	N/A
	Traditional CRADAs					
25	Active traditional CRADAs	0	0	0	1	0
26	Newly executed traditional CRADAs	0	0	8	1	7
	Non-traditional CRADAs					
27	Active non-traditional CRADAs	0	0	0	0	0
28	Newly executed non-traditional CRADAs	0	0	0	0	0
Enter “0” to report that the agency did not use this mechanism in the reported year. Enter "N/A" to report that data is not available at time of report. Add rows and interpretive notes as needed.						

Table 5 Other Performance Measures Deemed Important by the Agency

		FY09	FY10	FY11	FY12	FY13
	Others					
29	Collaborative Relationships	N/A	31*	39*	14*	26*
30	Total income, all licenses active in FY	$44	$17	$15	$7	$9
* Corrected data from previous years						
Enter “0” to report that the agency did not use this mechanism in the reported year. Enter "N/A" to report that data is not available at time of report. Add rows and interpretive notes as needed.						

1. Acoustic-based Technology to Detect Buried Pipes

Collaborative research between US DOT's Pipeline and Hazardous Material Safety Administration and the pipeline industry improved the Ultra-Trac® APL hand held acoustic pipe locator through multiple validation demonstrations at several urban utility sites. The research produced an algorithm that improves the process of locating pipes without using tracer wire (or broken wire). The algorithm assists pipeline operators and underground asset locators in detecting buried metallic and non-metallic pipes (Polyethylene and sewer pipes), reducing "excavation damages," and increasing the system and public safety. (DTPH56-10-T-000020)

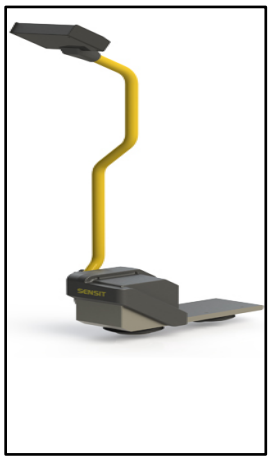

Figure 1 Ultra-Trac APL courtesy of SENSIT Technologies

2. Completion of Development of Robotics Systems for Inspecting Unpiggable Transmission Pipelines

Collaborative research between the US DOT's Pipeline and Hazardous Material Safety Administration and the pipeline industry led to the development and commercial deployment of the first ever robotic inspection platform (Explorer) and integrated Magnetic Flux Leakage sensor capable of internal unpiggable gas pipeline inspection through many internal obstructions including plug valves. Explorer is an untethered, modular, remotely controllable, self-powered inspection robot for the visual and nondestructive inspection of 20" and 26" natural gas transmission and distribution system pipelines. This technology was featured by ABC News out of San Francisco see here. DTPH56-10-T-000008

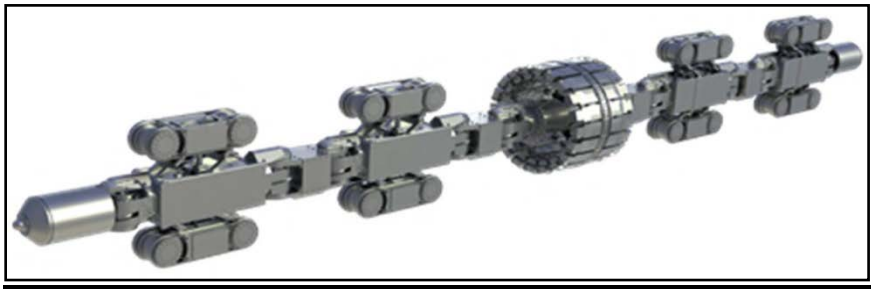

Figure 2 Explorer 20"/26" courtesy Pipetel Technologies

3. Consolidated Research Program to Map, Detect and Characterize Mechanical Damage Defects in Pipeline

This consolidated program and public/private funded research partnership between US DOT's Pipeline and Hazardous Material Safety Administration and the pipeline industry involved two distinct research project successes (Project #1 & Project # 2). Project #1 adapted JENTEK's Meandering Winding Magnetometer (MWM) Array and Magnetoresistive MWM Array for the detection and characterization of corrosion and mechanical damage characterization of pipeline damage from inside the pipe using an in-line inspection or JENTEK PIG-IT tool. Project #2 adapted JENTEK's MWM Arrays for the detection and characterization of corrosion and mechanical damage through coatings. Advancements were made in the sensor configuration, instrumentation layout, mechanical integration, and data processing algorithms. So the same technology in two different PHMSA projects brought tech transfer via in-ditch and ILI technology. This innovation began as PHMSA funded Small Business Innovative Research Phase I awards that were then competed within broader partnerships within PHMSA's core RD&T Program. (DTPH56-08-T-000009)

Figure 3 MWM Corrosion, Mechanical Damage and SCC imaging courtesy of JENTEK

4. A Quantitative Non-destructive Residual Stress Assessment Tool for Pipelines

The new eStress™ system for residual stress assessment of pipeline damage was developed, demonstrated and commercialized under a Pipeline and Hazardous Material Safety Administration (PHMSA) Small Business Innovative Research (SBIR) Phase II award. The SBIR Phase II award was supported by a successful SBIR Phase I award also funded by PHMSA. This inspection tool quantitatively measures residual stress in pipeline damage to determine the susceptibility of damaged regions to failure. The eStress™ system provide much more insight into the nature and severity of the stresses near dents and damage regions. This new nondestructive testing technology is coupled with advanced modeling techniques to dramatically improve the capability to not just determine the difference between good and bad amounts of stress but to quantitatively measure the local stress and map the stress around the entire area. Direct stress measurements such as these were not possible before the PHMSA investment and now provide for enhanced determination of mechanical damage defect severity in pipelines. DTPH56-12-V-000007

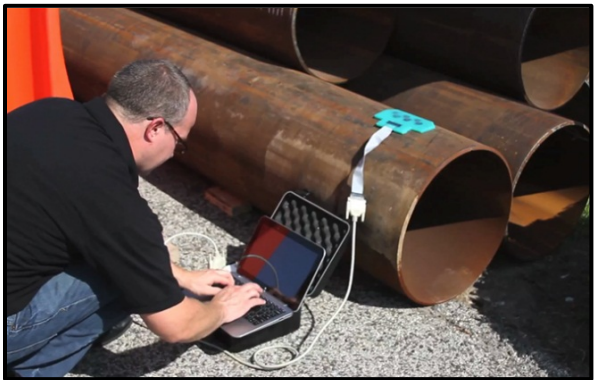

Figure 4 eStress™ Nondestructive Residual Stress Assessment System courtesy of G2MT LLC.

5. New App Puts Vehicle Safety in Consumers' Hands

A new iPhone application has made it easier for consumers to make important vehicle safety decisions in real time. Developed by Volpe National Transportation Systems Center for the National Highway Traffic Safety Administration (NHTSA), the SaferCar app allows users to access information from NHTSA's SaferCar.gov site to search vehicle 5-Star Safety Ratings, locate child seat installation help, file a vehicle safety complaint, and receive automatic notices about recalls. More information may be found here.

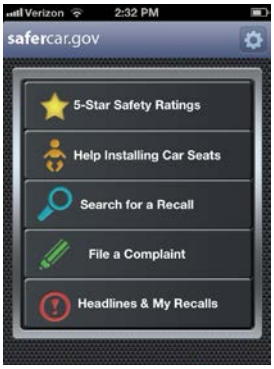

Figure 5 SaferCar app allows access to information to search vehicle 5-Star Safety Ratings

Volpe's team has a deep understanding of the data behind the app and how important the data are in improving transportation safety, having worked with NHTSA on vehicle recalls and safety complaints for 12 years. Volpe developed a major system of the SaferCar.gov website that handles safety complaints and recalls. Volpe's team also completed a major redesign of the website's user interface two years ago and provides all of the support for SaferCar.gov and NHTSA.gov.

With Volpe's knowledge of NHTSA's websites and systems, its team moved the app's development forward quickly, while working on advanced features like a function that allows users to scan VIN barcodes with their phones, making it easier to register their vehicles for safety recall notifications. The app's main features include the following:

- **5-Star Safety Ratings:** Searchable crash test ratings for vehicles by make and model and compare different vehicle ratings. Easy to shop smart at a car dealership. Since the app's release in March, about 10,500 users have downloaded the app.
- **Safety recalls and complaints:** Users can enter information for up to 10 vehicles to be notified of safety recalls. Simple for users to submit safety complaints about vehicles, helping NHTSA investigate defects.
- **Child seat installation help:** Users can find directions, hours, and contact information on the nearest car seat inspection station to get help installing child seats and boosters.
- **Safety news:** Consumers can receive important news and safety information from NHTSA, as well as notices on their registered vehicles.

6. Aircraft Braking Friction Project

The FAA has undertaken a research project for assessment of aircraft landings under contaminated runway conditions (i.e. snow, slush, and ice) in response to an NTSB recommendation issued in 2007. The objective of the project is to utilize aircraft systems data, generated during landings on contaminated runways to predict the landing performance of follow-on aircraft. The FAA has initiated Cooperative and Research Development Agreement's (CRDA) with both Team Eagle Ltd. Of Ontario, Canada and Engineered Arresting Systems Corporation (ESCO) with offices in Logan Township, NJ and Aston, PA for conducting joint research on the effects of contaminants on aircraft braking performance. The CRDA's provide FAA access to field experts of aircraft braking systems, surface condition reporting, and pilots knowledgeable with commercial aircraft operations. In addition, the CRDA's provide FAA with use of braking performance test data generated by the CRDA partners.

The FAA has instrumented a Boeing 727 aircraft (R&D 40 shown below) for conducting testing on contaminated runway surfaces. Instruments have been installed on the R&D 40 for measurement of braking friction and associated wheel slip (Mu-Slip) during stopping under varying contamination conditions. The performance of modern aircraft Anti-Skid Brake Systems (ASBS) is based on these Mu-Slip characteristics and can be used in the assessment of braking friction.

Figure 6 Boeing 727 aircraft

Team Eagle has developed a Braking Availability Tester (BAT shown below) which incorporates an aircraft tire with representative aircraft braking system and ASBS, within a commercial vehicle chassis. The objective of the BAT is to provide predictive braking availability on contaminated runway surfaces toward a better understanding of actual aircraft landing distances. Joint testing with the R&D 40 and the BAT is planned, under the CRDA, for this winter at ACY.

Figure 7 Braking Availability Tester

Pressure transducers supplied by ESCO have been installed into the R&D 40 main landing gear braking system. ESCO has an approved patent relating to the estimation of aircraft braking friction on contaminated runways using the hydraulic system pressure differentials across the ASBS control valves. Under the CRDA, the FAA and ESCO will jointly conduct braking friction testing with R&D 40 this winter at ACY.

Figure 8 Image showing pressure transducers

7. Automatic Speech Semantic Recognition and Verification in Air Traffic Control

The Federal Aviation Administration's (FAA) Technology Transfer Program maintains a Cooperative Research and Development Agreement (CRDA) with BrainVentions Corporation, Inc. of Los Angeles, CA. The purpose of this continued collaborative partnership is to conduct the exploration of automatic speech recognition technologies in Air Traffic Control (ATC) research.

The FAA conducts research to develop methods of measuring human performance in ATC environments through the use of Human-in-the-Loop (HITL) simulations and the collection of data recordings from fielded ATC operations. A portion of the data collected consists of voice data that can only be analyzed once the manual process of transcription has been completed. Unfortunately, the transcription process requires many man-hours to complete – therefore, some analyses are cost prohibitive.

Under the CRDA, FAA and BrainVentions investigate the current state of the art Automatic Speech Semantic Recognition (ASSR) technology, measure its accuracy, and explore its potential applications in ATC. The ASSR system used for this study is the ValsVox (BrainVentions) web-based Software as a Service (Figure 9) application for real-time speech recognition and semantic parsing of ATC voice communications. Case studies are conducted using an enhanced ValsVox system with recorded audio from previously conducted ATC HITL simulations.

ValsVox speech recognition is constrained in real-time by the semantic parsing - unlike other systems in which a transcript of the utterance is first generated then semantically parsed. For the phrases that were successfully recognized, accuracy of the semantic recognition was over 80%. These findings suggest that the technology may be ready for follow on research to incorporate ASSR into ATC decision support tools. There is also a potential to use ASSR in simulation and training environments. In addition, human transcriptionists could use ValsVox-generated transcripts to save time and costs when complete accuracy is needed.

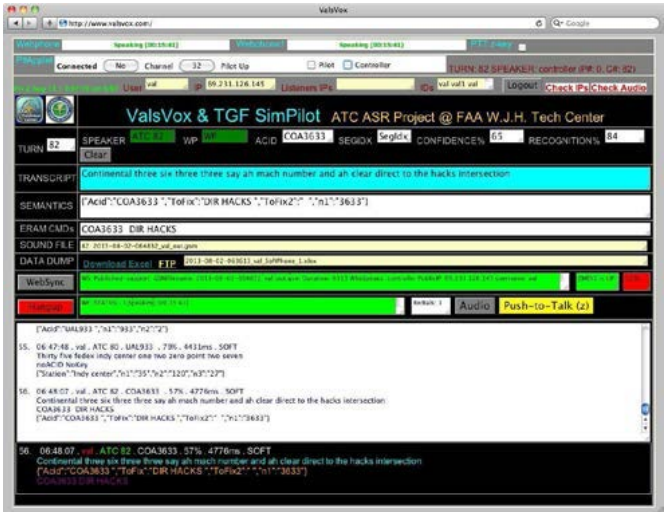

Figure 9 Automatic Speech Semantic Recognition software

8. *Geosynthetic reinforced soil–integrated bridge systems*

The Federal Highway Administration's "Bridge of the Future" initiative took a wise look at the past before soaring ahead to the future. The result was the Geosynthetic Reinforced Soil (GRS) Integrated Bridge System (IBS), which combined cutting-edge geosynthetics with ancient building secrets. This radically simple construction method can lower costs, slash construction time, improve durability, and increase worker safety. This technology uses alternating layers of compacted granular fill material and fabric sheets of geotextile reinforcement to provide support for a bridge. The technology also affords a smooth transition from the roadway to the bridge, alleviating the bump at the start and end of the bridge caused by uneven settlement. Thirty-five States have built more than 100 bridges using the technology. The technical team continues its work as part of a group focused on accelerated bridge construction. The team is providing workshops, training, showcases, conference presentations, and white papers, as well as participating in panel discussions.

9. *Prefabricated bridge elements and systems*

Prefabrication, which involves the manufacture and assembly of components or entire structures offsite, is solving many constructability challenges. The technology is revolutionizing bridge construction by greatly reducing onsite construction time, minimizing traffic disruptions, and improving work zone safety because of the reduced number of onsite workers exposed to moving traffic. State DOTs have designed or constructed more than 2,500 replacement bridges using prefabricated bridge elements and systems. In addition, nearly half of all States report that more than 25 percent of their replacement bridges have used at least one major prefabricated bridge element or system.

10.*High Friction Surface Treatments*

High friction surface treatments (HFST) are the site- specific application of very high-quality, durable aggregates using a polymer binder that restores and maintains pavement friction where the need for a safer pavement surface is the greatest. Maintaining the appropriate amount of pavement friction is critical for safe driving. Vehicles traversing horizontal curves require a greater side force friction, and vehicles at intersections require greater longitudinal force friction. The increased use of HFST to improve highway safety is (in part) a result of research and evaluations conducted by FHWA, industry partners, and leveraging research conducted by foreign countries. This research has shown the use of HRST resulted in decreases in overall crashes, and in many cases, severe crashes. HFST has been tried and proven in 11 States with a total of 23 installations as part of FHWA’s Surface Enhancements at Horizontal Curves (SEAHC) demonstration program. Crash data from the U.S. sites from Pennsylvania, Kentucky and South Carolina DOTs report a before/after total crash reduction of 100%, 90% and 57%, respectively, for their respective signature trial projects, for which the after periods equal approximately three to five years. Kentucky has gone on to install and measure 25 additional HFST applications, and after at least one year these sites have witnessed crash reductions of 69%.

11. NHTSA's VRTC Strikeable Surrogate Vehicle

Researchers at NHTSA's Vehicle Research and Test Center (VRTC) created a Strikeable Surrogate Vehicle (SSV) to serve as a Principal Other Vehicle (POV) during test track evaluations of forward crash avoidance and mitigation (FCAM) technologies such as Crash Imminent Braking and Dynamic Brake Support. A surrogate vehicle must be used in the evaluation of these systems since collisions between the test vehicle (known as the Subject Vehicle, or SV) and the POV may occur during testing. While it is important for the POV to be capable of sustaining repeated impacts, it must also present itself as realistic so as to be physically interpreted as a vehicle when testing with a SV. Balancing these requirements has been the focus of considerable research for years.

The NHTSA SSV features four novel elements in design:

1. It presents itself as a realistic vehicle to all known sensors presently implemented by forward-looking advanced warning and automatic braking systems.
2. The rigid body shell maintains a constant presence (free from buffeting) as approached by an SV.
3. A light-weight foam bumper and carbon fiber slider/load frame allows impact forces acting on an SV to be incrementally realized, thereby decreasing the peak loads present immediately after an impact occurs.
4. A constant SSV-to-tow vehicle distance is maintained, even during decelerating test maneuvers, using a towed rail that features skid plates designed to offer long-term durability and reduced in-the-field service.

The rear profile of NHTSA's SSV, (Figure 14, and specifically the face of the rear bumper forward to a vertical plane defined by the center of the rear wheels), is dimensionally similar to a small high-volume hatchback. To reduce the potential for damage to the SV during an impact, the SSV is constructed from carbon fiber, Kevlar, phenolic, and Nomex honeycomb; all of which are lightweight composite materials with favorable strength-to-weight characteristics. An assessment of the SSV radar return characteristics performed by the Michigan Technical Research Institute and the University of Michigan Transportation Research Institute concluded the SSV can be a viable POV for the evaluation of FCAM technologies. Feedback from the vehicle manufacturers and automotive suppliers generally has been favorable.

Figure 10 NHTSA's Surrogate Strikeable Vehicle

12. NHTSA's VRTC Supports Proposed Rulemaking for Child Side Impact Test Dummy

Researchers at NHTSA's Vehicle Research and Test Center (VRTC) provided four reports in support of a Notice of Proposed Rulemaking (NPRM) regarding the Q3s side impact test dummy, a new dummy representing a 3-year old child. The NPRM looks to amend the regulations to include specifications and qualification requirements for the Q3s Child Side Impact Test Dummy, which the Agency plans to use in testing child restraint systems for new side impact performance requirements.

The reports describe the qualities of the Q3s dummy that make it a suitable anthropomorphic test device during crash testing to improve side impact safety for children. These documents allow users of the dummy to ascertain the correct assembly, disassembly, and inspection procedures when utilizing the Q3s in their research, development and testing. Reports are publicly available in the NPRM's docket.

Test dummies specified in Federal Motor Vehicle Safety Standards (FMVSS) are subjected to a series of qualification tests to ensure that their components are functioning properly. The Qualification Procedures report demonstrates how the dummy is prepared for this testing, how the tests themselves are conducted, and the performance requirements to which the dummy must adhere to be acceptable for use in Regulatory testing.

The final report documents the Q3s's "Repeatability, Reproducibility, and Durability." This work evaluates the Q3s production version for potential use in Federal regulatory test standards. It includes the results of the repeatability and reproducibility of the Q3s dummy's responses in qualification procedures and sled tests. High-energy component tests were conducted to assess the dummy's durability. The Q3s dummy's repeatability and reproducibility generally rated as "excellent" or "good" as defined by the NHTSA rating system. Furthermore, the dummy proved to be a durable test device.

Figure 11 Q3s 3-Year-Old Child Side Impact Crash Test Dummy

13. In-situ measurement of the Neutral Temperature of Continuous-Welded Rail

The non-destructive, in-situ measurement of the Neutral Temperature (NT) of Continuous-Welded Rail (CWR) is a long-standing challenge in railroad safety and related rail maintenance. This is due to the fact that, even for a known laying temperature of the rail, several mechanisms affect the state of stress, so the thermal force of the rail in service at a given rail temperature is generally unknown. The FRA Safety Statistics Data for the period 2001-2006, within the category of Track, Roadbed and Structures, list Thermal Buckling as the second leading cause of train accidents (143 accidents, of which 141 resulted in derailments), with the highest associated reportable damage cost ($57M). High profile recent derailments associated with rail buckling include Union Pacific and DC Metro trains of summer of 2012.

Federal Railroad Administration's (FRA) sponsored research led to a novel technology (Rail-NT) developed by the University of California at San Diego (UCSD.) The technology measures high-frequency wave nonlinearities in rails that reach a minimum or maximum value when the rail passes through a state of zero stress. Rail NT is the rail temperature at this zero stress state. Knowing this temperature allows the railroad safety experts to predict a high risk of track buckling scenario. This technology enables field operators to take actions that minimize risks and prevent derailments.

FRA's Transportation Technology Center field tested the Rail-NT technology during the summer of 2012. In 2013, FRA's stakeholders Burlington Northern Santa Fe, Union Pacific, and AMTRAK tested the technology under railroad operating conditions for a comprehensive realistic evaluation with respect to both performance and economy. Field testing results shows promise for implementation that improves overall railroad safety and rail maintenance.

Figure 12 Buckling of a CWR.

Figure 13 The Rail-NT sensor head installed on a rail.

Table 6 DOT Technology Transfer summary on: CRADAs, inventions, patents, and other

Section	Description	*Fiscal Year*				
		2009	2010	2011	2012	2013
A	**Collaborative Relationships for Research and Development (CRADA)**					
	• CRADAs, total active in the FY	22	22	25	27	39
	- New, executed in the FY	7	0	8	1	7
	▪ Traditional CRADAs, total active in the FY	0	0	0	1	0
	▪ Non Traditional CRADAs, total active in FY	0	0	0	0	0
	▪ Other collaborative R&D relationships	2	2	5	5	26
B	**Invention Disclosure and Patenting**					
	• New inventions disclosed in the FY	3	1	2	2	13
	• Patent applications filed in the FY	2*	2*	2*	1	5
	• Patents issued in the FY	1	2*	0	0	1
C	**Profile of Active Licenses**					
	• All licenses, number total active in the FY	2	3	3	3	7
	▫ , executed in the FY	0	0	1	1	5
	▪ Invention licenses, total active in the FY	3	3	3	3	7
	executed in the FY	0	0	0	0	5
	▪ Other IP licenses, total active in the FY	0	0	2	2	0
D	**Characteristics of licensing bearing Income**					
	• All income bearing licenses, number	3	3	3	3	3
	▫ Exclusive	3	3	2	2	2
E	**Income from Licensing (thousands)**					
	• Total income, all licenses active in FY	$44	$17	$15	$7	$9
	▪ Invention licenses	$44	$17	$15	$7	$4
	▪ Other IP licenses, total active in the FY	$0	$0	$0	$0	$0
	• Total Earned Royalty Income, (ERI)	$34	$3	$8*	$6	$0

Note 1 *Corrections from previous reports.