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>U.S. DOT's Technology Transfer (T2) Report for FY2012</u>** |

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 2012 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 2012

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

**1/31/2013**

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

# FAA Launches Research Agreement to Address Radio Spectrum Congestion

Figure 1 Radio Spectrum

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

As the FAA migrates from the current NAS to the Next Generation Air Transportation System (NextGen) environment, increasing demands are being placed on spectrum in frequency bands used by Automatic Dependent Surveillance-Broadcast (ADS-B) and secondary surveillance radar. Communications for all these integral systems use the 1030/1090 Mhz frequency band.

The FAA identified 1030/1090 MHz radio spectrum congestion as a significant risk to the future of the ADS-B program, NextGen, and other safety-critical systems. The secondary radar surveillance systems that rely on 1030/1090 MHz frequency bands of the spectrum include: Air Traffic Control Beacon Interrogator Model 5 (ATCBI-5), ATCBI-6 and Mode-Select (Mode-S); all ASDE-X systems, including wide area multilateration (WAM) and precision runway monitor (PRM) multilateration subsystems; and traffic collision avoidance system (TCAS)/Airborne Collision Avoidance System (ACAS).

The FAA has conducted multiple studies, and has concluded that over-interrogation of aircraft by legacy radars limit transponder availability and produce a large number of unwanted replies (e.g., FRUIT), which contributes significantly to congestion of this spectrum. The main objective of the research performed under this CRDA is to reduce transponder occupancy time in order to alleviate 1030/1090 MHz spectrum congestion. The SELEX-FAA research team will establish specific research areas of interest. SELEX and FAA engineers then will work cooperatively to investigate performance enhancements and technology improvements to Mode-S transponders. The Department of Defense (DoD) also is participating in this research agreement, as it operates several systems that use the 1030/1090 Mhz frequency band.

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

## Innovative Welding Processes for Small to Medium Diameter Gas Transmission Pipelines

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

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

**Figure 2 Courtesy of CRC-Evans - pulsed gas metal arc welding**

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

- Communication software was developed to control a mechanized welding bug through RS232 communication.
- Automated torch travel angle control hardware was developed and integrated with the mechanized bug system.
- Automated torch travel angle control software was developed and integrated with the mechanized bug system.
- Spin Arc (GMAW-RE) torch hardware was integrated with the mechanized bug system.
- A control system was developed for the Spin Arc torch and integrated with the automated torch travel angle control.
- A building block for real time quality measurement (RTQM) was developed and data gathered for future analysis with data acquisition from a cost-matched project.
- An automatic control system was developed using the RTQM data acquisition system for measuring mean welding current and using this to maintain a user specified contact tip to work distance (CTWD) during welding.
- The welding demonstration deployed the developed Spin Arc welding parameters.

## FAA CRDA with RFID TagSource Reaches Major Milestone

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

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

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

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

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

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

**Figure 3 WJHTC Technical experts discussing wing's mounting protocols before flight test.**

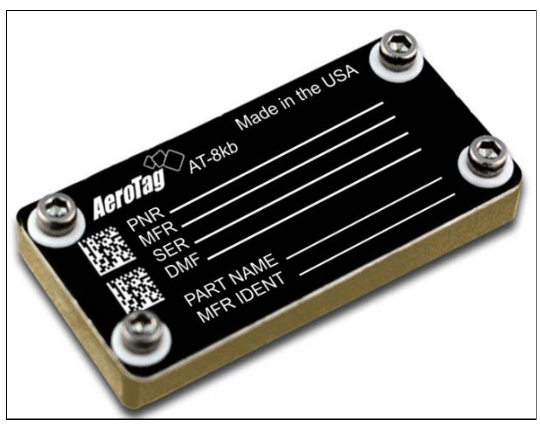


**Figure 4 Radio Frequency Identification Ta**

## Technical and Economic Feasibility of Preventing SCC through Control of Oxygen

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

Stress corrosion cracking (SCC) has been observed in carbon steel tanks and piping in contact with fuel grade ethanol (FGE) in user terminals, storage tanks, and loading/unloading racks. Previous detailed laboratory studies demonstrated that, in ASTM D-4806 fuel grade ethanol, dissolved oxygen was the most important factor leading to SCC, followed in importance by pre-existing scale on steel, chloride, and methanol. In a Roadmapping Workshop conducted in October 2007, methods to avoid oxygen contamination in ethanol and defining safe operating limits in terms of ethanol chemistry and oxygen concentration were identified as major gaps in the safe transportation of ethanol in pipelines. More information can be found here.

**Figure 5 DSP 4000 oxygen probe courtesy of Det Norske Veritas (U.S.A.), Inc.**

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

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

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

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

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

SaferBus has been featured in USA Today's Travel section as one of "Five Travel Apps That Could Save Your Life" and by ABC News as a safety resource to use before booking your summer vacation.

Volpe's team utilized non-proprietary software and subscription services, thus reducing the high licensing costs associated with the traditional software development model.

FMCSA has asked Volpe to develop a SaferBus app for the Android platform as well, which would expand the tool's mobile reach beyond the Apple iPhone and iPad devices.

**Figure 5 Developed together with FMCSA, the SaferBus app gives travelers mobile access to important safety data.** ***(Volpe Photo)***

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

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

(See Volpe Center report by Aaron Hastings, John K. Pollard, Lisandra Garay-Vega, Mary D. Stearns and Catherine Guthy, Quieter Cars and the Safety of Blind Pedestrians, Phase 2: Development of Potential Specifications for Vehicle Countermeasure Sounds)

These recommendations were implemented by NHTSA in rulemaking: On January 7, 2013, NHTSA posted proposed rulemaking with these new sound requirements and the related environmental impact statement embedded in the press release here.

**Figure 6 Blind pedestrians listen for the sound of a passing hybrid vehicle.** ***(National Federation of the Blind)***

## Volpe/FRA Technical Criteria and Procedures for Evaluating Alternatively Designed Passenger Rail Equipment Successfully Applied

The passenger rail industry is on the cusp of tremendous growth. With the proliferation of planned passenger rail systems around the country, more States and operating authorities desire to use passenger equipment designed to meet alternative standards, which have been proven in foreign operating conditions but not under the more stringent regulations in the United States.

In its role as administrator and enforcer of railroad safety regulations, the Federal Railroad Administration (FRA) receives petitions to waive regulations that apply to rail passenger equipment. To provide for safety while making best use of its resources and to facilitate passenger rail industry growth, FRA has decided to develop, in consultation with the rail industry, alternative criteria and procedures for assessing the crashworthiness of rail passenger trainsets that are applicable to a wide range of equipment designs. Sponsored by FRA, the Volpe authors developed criteria and procedures intended for use by the rail industry in developing information to support waiver petitions and by FRA in evaluating waiver petitions for Tier I service trainsets or those operated at speeds up to 125 miles per hour (mph).

(See report by Michael Carolan, Karina Jacobsen, Patricia Llana, Kristine Severson, Benjamin Perlman and David Tyrell, Technical Criteria and Procedures for Evaluating the Crashworthiness and Occupant Protection Performance of Alternatively Designed Passenger Rail Equipment for Use in Tier I Service.)

In June, 2012, the FRA, assisted by the Volpe Center, approved the first alternative design waiver[1] for the Denton County Transportation Authority (DCTA) assisted by LTK Engineering, to purchase and operate 11 new diesel-electric (DMU) light-weight, low-floor Swiss-made GTW Stadler unit cars on it's a-Train 21 mi commuter rail line shared with freight trains, and linked to DART. These light-weight railcars are expected to be more fuel efficient by 30-70%, operate up to 75 mph with less noise, and feature a Tier 1 crash energy management (CEM) system.

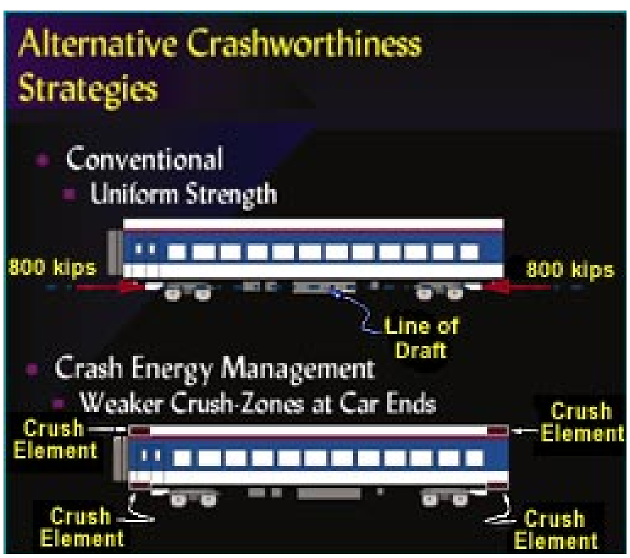


**Figure 7 Alternative Crashworthiness Strategies** ***(Volpe Center photo)***

## Volpe Center Identifies Ways to Speed Up the Delivery of Intelligent Transportation Technologies (ITS) with an Analysis of the Factors Influencing ITS Technology Adoption and Deployment.

Sponsored by the DOT/RITA Intelligent Transportation Systems (ITS) Joint Program Office (JPO), the Volpe Center report presented the results of a quantitative analysis of the factors that influence the deployment and diffusion of intelligent transportation systems (ITS) by state and local governments across the U.S. This analysis was based on the deployment tracking database maintained by the Joint Program Office (JPO) and examined the key historical influences on both the adoption and deployment of ITS technologies since the late 1990s. The results from this study provide the USDOT with statistical insight that can be used to guide future research and inform strategic and policy making. In addition, it provides insight into where the current ITS markets are in terms of market evolution, which can help to identify technologies that are mature and ready for replacement by next generation technologies.

(See report by David Pace, Rachel West, Garrett Hagemann, Paul Minnice, Arlen Spiro and Sari Radin, An Analysis of the Factors Influencing ITS Technology Adoption and Deployment)

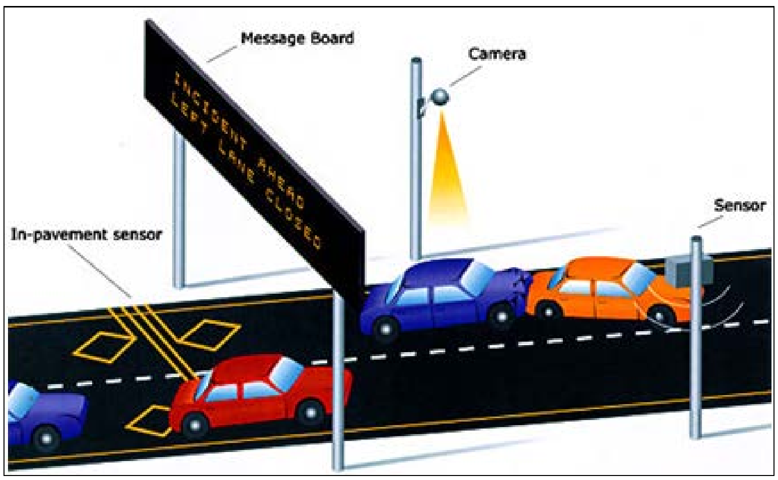


**Figure 8 ITS technologies available on highways** ***(Courtesy of Missouri Department of Transportation)***

## Volpe Center and FHWA Facilitate Adoption of Renewable Energy and Fuels as Alternative Uses of Highway Right-of-Way

Sponsored by the Federal Highway Administration (FHWA) Office of Real Estate Service, a Volpe Center report investigated the state of practice in accommodating renewable energy technologies and alternative fuel facilities within highway right-of-way (ROW). Recognizing there are considerable economic, ecological, legal and political uncertainties, this report was intended to provide transportation agencies with the information that will better enable them to consider the implications and evaluate the feasibility of implementing renewable energy and fuel options in the ROW.

(See Volpe and FHWA report by Carson Poe, Gina Filosa, Julianne Schwarzer, Aviva Brecher and Katherine Millette here.)

FHWA issued guidance on how to best utilize highway right-of-way (ROW) for renewable energy production and use here.

On August 21st, 2012 the Volpe team and FHWA jointly conducted a webinar for state and local government and industry partners to discuss ways to advance projects accommodating renewable energy technologies and/or alternative fuel facilities (e.g., solar installations, wind turbines, bioenergy crop/biomass production) within highways ROW. The Volpe team reviewed the state of the practice for implementing alternative ROW uses, to enable State DOTs in advancing projects that can accommodate renewable energy or alternative fuel projects within the highway ROW in environmentally compatible ways.

**Figure 9** Alternative Uses of Highway Right-of-Way: Accommodating Renewable Energy Technologies and Alternative Fuel Facilities

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

| *Table* | Description | *Fiscal Year* | | | | |
|---|---|---|---|---|---|---|
| | | 2008 | 2009 | 2010 | 2011 | 2012 |
| **A** | **Collaborative Relationships for Research and Development** | | | | | |
| | • CRADAs, total active in the FY | 23 | 22 | 22 | 25 | 27 |
| | - New, executed in the FY | 6 | 7 | 0 | 8 | 1 |
| | ▪ Traditional CRADAs, total active in the FY | 23 | 0 | 0 | 0 | 1 |
| | ▪ Non Traditional CRADAs, total active in FY | 0 | 0 | 0 | 0 | 0 |
| | ▪ Other collaborative R&D relationships | 0 | 2 | 2 | 5 | 5 |
| **B** | **Invention Disclosure and Patenting** | | | | | |
| | • New inventions disclosed in the FY | 3 | 3 | 1 | 2 | 2 |
| | • Patent applications filed in the FY | 2* | 2* | 2* | 2* | 1 |
| | • Patents issued in the FY | 4* | 1 | 2* | 0 | 0 |
| **C** | **Profile of Active Licenses** | | | | | |
| | • All licenses, number total active in the FY | 5 | 2 | 3 | 3 | 3 |
| | ▫ , executed in the FY | 0 | 0 | 0 | 1 | 1 |
| | ▪ Invention licenses, total active in the FY | 5 | 3 | 3 | 3 | 3 |
| | ▫ , executed in the FY | 0 | 0 | 0 | 0 | 0 |
| | ▪ Other IP licenses, total active in the FY | 0 | 0 | 0 | 2 | 2 |
| **D** | **Characteristics of licensing bearing Income** | | | | | |
| | • All income bearing licenses, number | 4 | 3 | 3 | 3 | 3 |
| | ▫ | 1 | 3 | 3 | 2 | 2 |
| **E** | **Income from Licensing (thousands)** | | | | | |
| | • Total income, all licenses active in FY | $18 | $44 | $17 | $15 | $7 |
| | ▪ Invention licenses | $18 | $44 | $17 | $15 | $7 |
| | ▪ Other IP licenses, total active in the FY | $0 | $0 | $0 | $0 | $0 |
| | • Total Earned Royalty Income, (ERI) | $9 | $34 | $3 | $8* | $6 |

**Note 1 *Corrections from previous reports.**