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, Director for the Office of Research, Development, and Technology**

SUBJECT: **U.S. DOT's Technology Transfer (T2) Report for FY2014**

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 2014 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 2014

Office of the Assistant Secretary for Research and Technology

1/31/2015

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

		FY10	FY11	FY12	FY13	FY14
	Invention Disclosure					
1	Number of new inventions disclosed	1	2	2	13	3
	Patents					
2	Number of patent applications filed	2	2	1	5	0
3	Number of patents received	4	0	4	1	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

		FY10	FY11	FY12	FY13	FY14
	Income Bearing Licenses					
4	Number of income bearing licenses	3	3	2	3	1
5	Exclusive licenses	1	1	0	0	1
6	Partially exclusive licenses	0	0	0	0	0
7	Non-exclusive licenses	2	2	2	3	0
FAA licenses are non-exclusive						
	Elapsed Amount time to Grant Licenses					
8	Average (months)	N/A	N/A	N/A	N/A	N/A
9	Minimum (months)	N/A	N/A	N/A	N/A	N/A
10	Maximum (months)	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

		FY10	FY11	FY12	FY13	FY14
	Earned Royalty Income					
11	Earned Royalty Income from top 1% of licenses	N/A	N/A	N/A	N/A	N/A
12	Earned Royalty Income from top 5% of licenses	N/A	N/A	N/A	N/A	N/A
13	Earned Royalty Income from top 20% of licenses	N/A	N/A	N/A	N/A	N/A
14	Minimum Earned Royalty Income	N/A	N/A	N/A	N/A	N/A
15	Maximum Earned Royalty Income	N/A	N/A	N/A	N/A	N/A
16	Median Earned Royalty Income	N/A	N/A	N/A	N/A	N/A
	Disposition of Earned Royalty Income (thousands)					
17	Total amount of Earned Royalty Income received	$17	$18.2	$7.4	$8.8	$22.6
18	Percent of Earned Royalty Income distributed to inventors	N/A	35	45	42	32
19	Percent of Earned Royalty Income distributed to the agency or laboratory	N/A	N/A	N/A	N/A	N/A
20	Licenses terminated for cause	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

		FY10	FY11	FY12	FY13	FY14
	CRADAs					
21	Number of Active CRADAs	22	25	29	40	50
22	Number of newly executed CRADAs	0	8	12	8	10
23	Active CRADAs with small businesses involvement	0	8	12	8	10
24	Number of small businesses involved in active CRADAs	0	0	3	3	5
	Traditional CRADAs					
25	Active traditional CRADAs	0	0	3	3	7
26	Newly executed traditional CRADAs	0	0	0	0	2

	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

		FY10	FY11	FY12	FY13	FY14
	Others					
4	Collaborative Relationships	29	39	14	26	30
5						
6						
7						

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. Partnering with States for Better, Faster, and Smarter Ways to Build Highways

Every Day Counts is the Federal Highway Administration's (FHWA) initiative to advance a culture of innovation in the highway community in partnership with States. Through this collaborative, State-based effort, FHWA coordinates rapid deployment of proven, market-ready strategies and technologies to shorten the project delivery process, enhance roadway safety, and improve environmental sustainability. The initiative is designed to create a new sense of urgency in pursuing better, faster, and smarter ways to build highway infrastructure. Through the EDC initiative, the highway community has created a national innovation deployment network and established the foundation for a culture committed to innovation.

Figure 1 Dingle Ridge Road bridge replacement project using slide-in bridge construction method (New York State), Photo by FHWA

Since EDC's inception, every State Department of Transportation (DOT) has utilized at least two of the promoted innovations. For example, transportation agencies have designed or constructed more than 2,500 replacement bridges using Accelerated Bridge Construction (ABC) technologies since the inception of this program. ABC is a suite of technologies (innovative planning and construction methods, designs, and materials) that allow for accelerated construction of bridges, significantly reducing traffic delays and road closures and often reducing project costs. Using ABC, transportation agencies have been able to replace bridges within 48 to 72 hours and reduce the planning and construction of bridge projects by years. The Nevada DOT replaced two bridges in Mesquite using Slide-in Bridge Construction (SIBC) method. The roadway was shut down for just 56 hours compared to the months of construction zone delays under traditional construction methods. The SIBC approach translated into saving an estimated $12.7 million in time and fuel costs for commuters. When a span of the I-5 Skagit River Bridge in Washington collapsed after being struck by a truck carrying an oversize load, a temporary bridge was quickly put in place while a new bridge was built adjacent to the original alignment, out of the way of traffic. In one night, the temporary bridge was removed and the new bridge was slid into place.

As the bridge sector increasingly moves towards the use of ABC technologies, researchers at the FHWA's Turner-Fairbank Highway Research Center (TFHRC) in McLean, VA, continue studying materials, structural performance, and novel connection details to address the needs of bridge owners and highway stakeholders. TFHRC-developed solutions are being deployed today to rapidly and safely construct bridges while minimizing the impact on the traveling public. More examples of EDC success stories can be found at www.fhwa.dot.gov/everydaycounts/

2. FHWA Sustainability Tool Facilitates Local Partnerships for More Sustainable Highways

FHWA launched the Infrastructure Voluntary Evaluation Sustainability Tool (INVEST), FHWA's sustainability self-assessment tool that enables State Departments of Transportation (DOTs) and Metropolitan Planning Organizations (MPOs) to evaluate and improve the sustainability of their transportation plans, projects, and programs. INVEST is helping State DOTs, MPOs, and others consider sustainability through every phase of the transportation infrastructure lifecycle, including system planning, project design and construction, maintenance, and operation. The tool helps transportation agencies make informed decisions with limited resources to balance economic, social, and environmental factors.

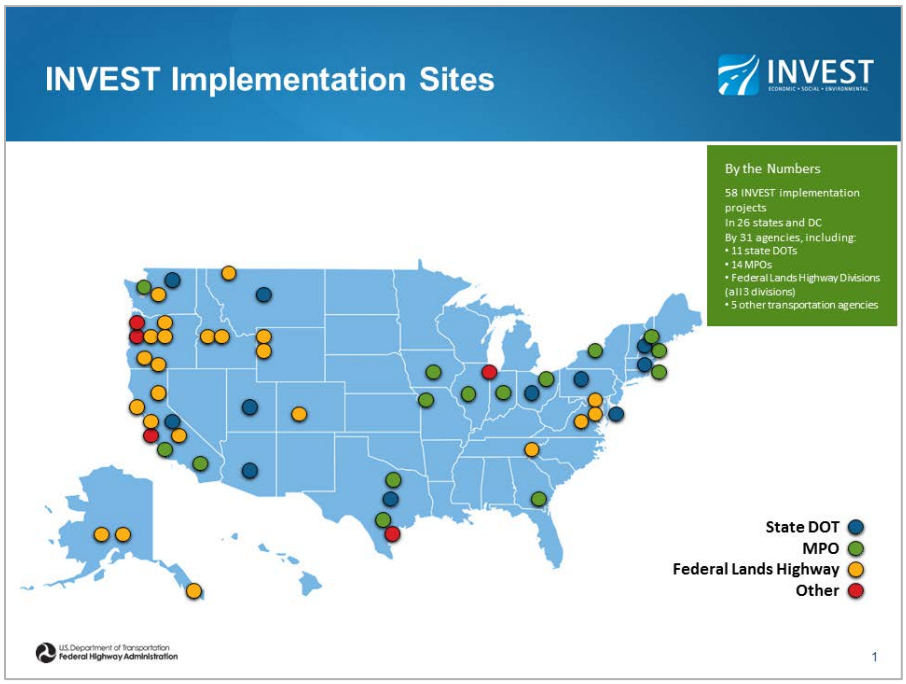

Figure 2 INVEST has been deployed by 31 agencies all over the country, as shown in the map above.

For example, INVEST helped the Ohio Department of Transportation (ODOT) improve the sustainability of the largest project in ODOT history, the replacement of the Cleveland Innerbelt Bridge on I-90, now called the George V. Voinovich Bridge. The high priority bridge replacement project involves a coast-to-coast interstate highway and affects a historic district and a high traffic sports complex. As such, ODOT saw achieving sustainability goals as critical and targeted major savings in fuel, steel, water, and waste. ODOT used INVEST to validate sustainability achievements and found that the project was meeting and exceeding its goals. In fact, the project:

- Saved more than 100,419 gallons of diesel fuel – enough to power a big-rig from Cleveland to Salt Lake City… and back, 145times.
- Recycled more than 5,658,078 pounds of steel. About the weight of 1,414 average-size sedans.
- Saved 22 million gallons of water. Enough to power a shower around the clock for almost eight years.

- Prevented more than 125,143 cubic yards of waste from entering landfills – more than twice the concrete it took to build First Energy Stadium – home of the Cleveland Browns.
- Separated stormwater from combined sewers draining 20 acres, treating the separated runoff with extended detention basins and reducing pollution to the Cuyahoga River.

Many more INVEST case studies can be found at www.sustainablehighways.org.

3. FHWA Provides Incentives to States to Field Test Research Results

In coordination with the American Association of State Highway and Transportation Officials (AASHTO) and the Transportation Research Board, FHWA is encouraging transportation agencies to field test and deploy research results, referred to as SHRP2 Solutions, to determine if they will ultimately be adopted as standard business processes and practices. SHRP2 is the second Strategic Highway Research Program, which was established by Congress in 2005 to undertake highway research to address critical state and local challenges, such as aging infrastructure, congestion, and safety. The research results are now being made available in a series of effective solutions that will improve the way transportation professionals plan, operate, maintain, and ensure safety on America's roadways.

Through the SHRP2 Implementation Assistance Program (IAP), FHWA provides financial and technical assistance to eligible State Departments of Transportation (DOTs), Metropolitan Planning Organizations, local transportation entities and others to help offset the costs and risks of early adoption of innovation.

Figure 3 Trained first responders manage "on-scene" traffic flow to more quickly clear crashes.

For example, more than 60,000 traffic incident responders in 45 states and the District of Columbia have been trained using a new curriculum developed through SHRP2. The National Traffic Incident Management (TIM) Responder Training program was designed to build teams of well-trained responders, including police, fire, highway workers, emergency medical, towing and public works, who collaborate on-scene. Participants learn "safe quick clearance" techniques such as the correct placement of response equipment and traffic control devices and how to create a safer work area. This SHRP2 program will enable responders to more quickly clear crashes, which will reduce secondary accidents and traveler delays due to resulting congestion. So convinced of its value, several States are now requiring their law enforcement, fire/rescue, emergency medical services, DOT, towers, and other emergency responders to take the training.

More examples of SHRP2 solutions in action can be found at www.fhwa.dot.gov/goshrp2.

4. NHTSA's Vehicle to Vehicle (V2V) Communications Technology

The National Highway Traffic Safety Administration's (NHTSA) Vehicle to Vehicle Communications Program, in collaboration with Intelligent Transportation Joint Program Office, developed, tested, and evaluated this new communications safety technology. A broad range of stakeholders including vehicle manufacturers, other USDOT modes, academia, industry associations, state and local transportation departments, and equipment suppliers collaborated with NHTSA in this effort. This program led to a decision by USDOT to work towards a proposal to require the technology in all new vehicles in a future year.

The program developed and demonstrated key safety applications, such as intersection crash warning and generated data to help evaluate the benefits and customer acceptance of these applications. In the area of vehicle interoperability, the V2V program demonstrated compatibility of radio systems from multiple vendors, verified interoperability among different vehicle types from different vehicle manufacturers (cars, trucks, buses), and developed and demonstrated aftermarket and retrofit devices that can bring the technology to the existing vehicle fleet faster. The program also demonstrated the feasibility of using automotive grade GPS receivers for positioning; completed initial scalability testing via simulation and real world tests to show the technology could "scale" to potentially millions of vehicles in the future when deployed; and showcased the feasibility of the technology in a variety of real world environments via performance testing in multiple urban and rural settings, including a 3000 vehicle model deployment. Finally, the program developed a wireless communications approach which would help maintain appropriate privacy protections while ensuring security and trust of messages. The approach leverages proven public key infrastructure (PKI) technology, adapting PKI for a mobile environment. The approach was successfully demonstrated in a real world setting during the model deployment.

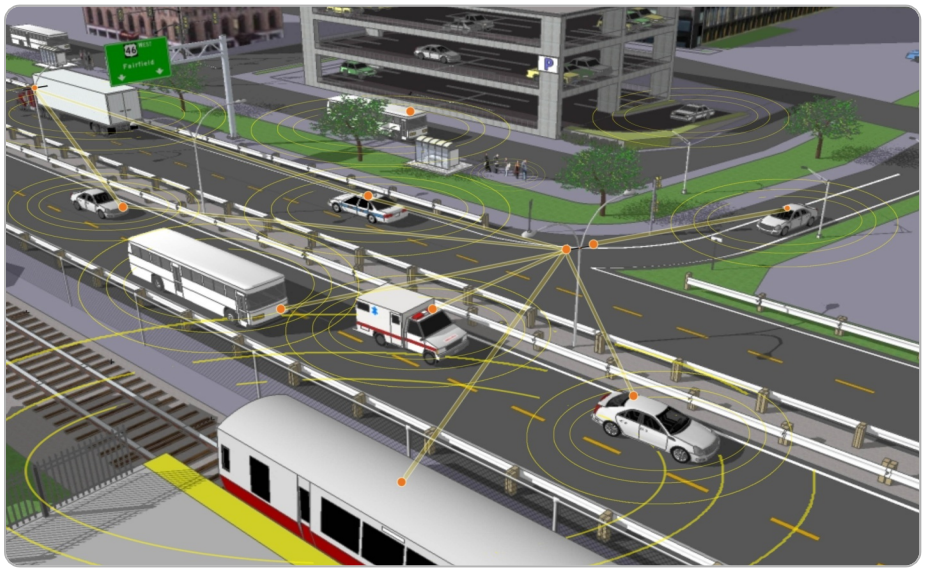

Figure 4 Illustration of a V2V environment where vehicles "talk" to each other exchanging information in real time (10 times per second) including: vehicle size, position, speed, heading, to enable safety applications.

5. NHTSA's Robotic Child Pedestrian for Use in Evaluating the Effectiveness of Vehicle Crash Avoidance Technologies

NHTSA's activities supporting the 2014 revision of Federal Motor Vehicle Safety Standard No. 111 to expand vehicle rear visibility included research and the development of innovative tools for the evaluation of crash avoidance technologies. One such innovation was the use of a programmable, remote-controlled robot platform to create a strikeable surrogate pedestrian. The programmable robot platform accepted custom programming to achieve a straight path, specific speed, and stopping point without need for a track or suspension. This robotic pedestrian could be safely deployed in the path of unsuspecting drivers participating in controlled research studies in which their use of crash avoidance system warning information was observed. This unexpected event was presented when drivers were backing out of a garage, a scenario in which approximately 200 pedestrians are killed and thousands are injured every year when struck by a backing vehicle.

To accurately represent the backover crash type, the robotic platform was programmed to move at a speed simulating the actual walking speed of a child of approximately 2.5 years of age. The robot's motion was automated using computer programming such that it moved in a straight path and stopped at approximately the vehicle's centerline. Stopping between the vehicle's wheel paths, increased the likelihood that the robot would not get struck by a wheel if a participant took a generally straight backing path. In the rare event that a test participant backed using a curved path, there was no damage to the robot since the robot had a ruggedized durable metal shell having a sloped lip on all four sides to allow a vehicle to drive over it, as shown in Figure 1.

Mounted to the ruggedized robot shell was a rigid, two-dimensional, life-size color image of a 36-inch-tall child mounted to the remote-controlled robot platform (depicted below) to simulate a pedestrian of the age most frequently involved in backover crashes.

Figure 5 Photo of Programmable Robotic Child Obstacle as Presented in NHTSA Research Evaluating the Effectiveness of Rear Visibility Crash Avoidance Aids for Drivers

A light beam sensor was used that, when triggered, would send a signal to a computer controlling the robotic pedestrian to begin its motion. The robotic pedestrian started out of view on the passenger-side of the vehicle and then moved laterally toward the vehicle's path.

Results of this research that made use of the innovative robotic pedestrian were used as part of our effort to quantify the possible benefits of crash avoidance technology for mitigating backover crashes.

6. SafetyHAT: Successful and Rapid Transfer of a New Transportation System Safety Hazard Analysis Tool

In March 2014, Volpe, the National Transportation Systems Center, released for licensing the Safety Hazard Analysis Tool (SafetyHAT). This software tool facilitates hazard analysis using the System-Theoretic Process Analysis (STPA). STPA is a hazard identification method based on a top-down system engineering approach and control systems theory. While some familiarity with STPA is expected before using this tool, one of the primary goals of SafetyHAT is to help safety analysts become proficient with the STPA method. It includes transportation-oriented guide phrases and causal factors that tailor the STPA method to transportation systems.

SafetyHAT guides analysts through the preparatory and analysis steps of STPA, and leverages the power of a relational database to organize and manage the large quantity of data that the analysis may produce. It facilitates the documentation of hazard analysis. It has also prompted inquiries on how STPA might be used for assessing human behavior as part of railroad grade crossing safety systems, cyber-security threats, and infrastructure safety hazards arising from extreme weather events.

SafetyHAT is available for public use and can be downloaded for free at http://www.volpe.dot.gov/advanced-transportation-technologies/advanced-vehicle-technology/safetyhat-transportation-system A user guide and informational video are also posted there to facilitate new applications. Diverse SafetyHAT users include span all transportation sectors, as well as in energy, healthcare, insurance industries, and the military. In the first 9 months since its public release, SafetyHAT attracted more than 200 **users worldwide**, distributed across **industry** (41 percent), the **public sector** (36 percent), and **academia** (23 percent).

The Federal Labs Consortium (FLC) has posted SafetyHAT technology as "ready for transfer" in April, 2014 at http://newslink.federallabs.org/2014/04/08/safetyhat-a-transportation-system-safety-hazard-analysis-tool/ SafetyHAT was also recognized with the Federal Lab Consortium's (FLC) Northeast 2014 Excellence in Technology Transfer Award, see http://www.volpe.dot.gov/news/safety-hazard-analysis-tool-receives-excellence-technology-transfer-award

7. Volpe Center Planners Successfully Assisted Communities To Prepare for Climate Change

Volpe environmental and community planners have supported the Federal Highway Administration (FHWA) and numerous other agencies to create models of collaboration in Cape Cod and Central New Mexico that address climate change through an integrated scenario planning process in transportation and land use plans. Many local agencies account for climate change in their community or unit-level planning. But a disjointed climate change plan may develop when numerous local agencies in one region address climate change in different ways, while trying to comply with regulations from federal agencies. When climate change strategies aren't cohesive and regional, they rarely lead to the positive environmental impacts that planners envision. The FHWA tapped Volpe experts in environmental, transportation, and community planning to facilitate and coordinate a climate change scenario planning process in Cape Cod and Central New Mexico. Volpe held bi-weekly talks with federal and local partners and agencies and organized technical committees to identify greenhouse gas reduction strategies and likely climate change impacts in both regions. FHWA and Volpe brought numerous agencies and public stakeholders to the table to develop solutions that are implementable, realistic, and collaborative, as described at http://www.volpe.dot.gov/transportation-policy-planning/transportation-planning/climate-change-cape-cod-and-new-mexico

Figure 6 Climate change considerations

Figure 7 Coordination and collaboration among DOT and numerous stakeholders

Analysis from the Central New Mexico project will influence how the Mid-Region Metropolitan Planning Organization in Albuquerque will develop its Metropolitan Transportation Plan, which guides federal, state, and local transportation investments. The project findings will be shared with local planning agencies and used in hazard-mitigation plans. Federal agencies that manage land in the region, such as the Bureau of Land Management and the U.S. Fish and Wildlife Service, will use the results in their management plans. More information is available at Central New Mexico Climate Change Scenario Planning Project

The Cape Cod scenario planning project boiled down one refined development scenario that is now the basis for all planning agencies to try to implement over the next 20 years. A cohesive vision on climate change greatly increases the odds that transportation and land use planning in Cape Cod will lead to fewer negative impacts from climate change, see Cape Cod Project One-Pager.

8. Wake Turbulence Research Increases Airport Capacity and Is Making Air Travel Safer, Greener

As airplanes move through the air, counter-rotating horizontal tornadoes are generated off the wings. This phenomenon, known as wake turbulence, creates a potentially dangerous situation for trailing aircraft. The Federal Aviation Administration (FAA) counts on experts at Volpe Center to understand the behavior of wake turbulence and to recommend adjustments to aircraft separation standards. Volpe's experts performed the following research:

- Collecting data at or near airports, often pioneering methods and equipment used to conduct the observations.
- Analyzing the data, systems, and procedures to inform FAA policies and regulations.
- Supporting efforts to implement new wake turbulence procedures around the globe

Figure 8 Visible wake turbulence from aircraft.

- Volpe Center research on aircraft wake turbulence in support of FAA was instrumental in increasing capacity at Memphis International Airport by 19 percent, as well as making air traffic safer and greener. A new infographic at http://www.volpe.dot.gov/content/infographic-wake-turbulence-separation-standards-aircraft provides an easy-to-read data visualization describing how our improved understanding of wake turbulence results in airspace efficiencies.

For more information, see the related Volpe news stories at:

http://www.volpe.dot.gov/news/wake-turbulence-research-increases-airport-capacity-new-infographic-shows and http://www.volpe.dot.gov/news/new-aircraft-separation-standards-gain-wider-adoption-saving-time-and-money

9. Small Business Innovation Research (SBIR) Activities

The Federal Aviation Administration's (FAA) federal laboratory, William J. Hughes Technical Center in Atlantic City, New Jersey, manages SBIR activities through its Technology Transfer (TT) Program Office. SBIR agreements provide the FAA opportunities to work with small businesses in a phased approach to accomplish fundamental and basic research applicable to the agency's missions. In FY14, the FAA's TT Program Office managed three SBIR initiatives.

System Technology, Inc. (STI) began a Phase II SBIR project to create spatial disorientation in flight simulation and evaluate enhanced spatial disorientation training. The research team completed review of a commercial transport loss of control database and set up initial requirements for the candidate spatial disorientation illusions that will be examined in piloted simulations. The team also updated the software tools for monitoring and analyzing the training results. The analyses will continue to develop and verify test scenarios. A pilot-in-the-loop simulation experiment is expected to be conducted at the National Aeronautics and Space Administration Ames B747-400 simulator facility in 2015.

Lynntech Inc, College Station, TX. was selected for Phase I award to conduct a feasibility study about development of a command and control system for incident command during airport emergency events. Lynntech offers the NIVS (National Incident Visualization System), which proposes integration of a NIVS server and a NIVS Incident Command View (ICV) presented on smartphone technology, all coordinated through a NIVS application. It uses smartphone technology but does integrate P25 radio systems as well. The NIVS server would aggregate all Airport Emergency Plan (AEP) and other applicable airport information documents for use by incident command staff. The NIVS IC view would also integrate a "Graphic User Interface" environment application where preregistered users would show up in the system when entering boundaries (geofencing). The system would use barcodes to track foam and other agents deployed by Aircraft Rescue and Firefighting (ARFF)/rescue vehicles, using integrated sensors applied to vehicles. This same system is proposed for the patients/victims tracking as well, and would be a low cost solution . Additionally Lynntech proposes to partner with companies Astin, Fibertown, and Texas A&M Extension for completion of important parts of the project.

M42 Technologies, LLC, in Seattle, WA, was selected for a Phase I award to investigate Transponder and Small Satellite for 1090 MHz ADS-B Commercial Space Vehicle Tracking. Commercial space vehicles licensed by the FAA include launch vehicles, re-entry vehicles and manned high altitude balloons. Operations of commercial space vehicles will become increasingly frequent and then routine in various regions of the US. The primary objective of this research is to ensure that no degradation to both the safety and efficiency of the National Airspace (NAS) for other NAS users such as commercial general and military aviation occurs as commercial space vehicles become routine. The proposed research will build on existing Automatic Dependent Surveillance-Broadcast (ADS-B) to perform surveillance of commercial space vehicles as they transition through the NAS either on the ascent or descent phases of flight by building on existing, operational, and flight- proven 1090MHz ADS-B technology. Accordingly, while ADS-B is potentially a favorable candidate for surveillance of commercial space operations, extensive research is required to determine the necessary operational,

functional, and physical system characteristics for development of an adequate spacecraft surveillance platform(s).

10.FAA Beam Structure Test Article and Fixture

The FAA William J. Hughes Technical Center federal laboratory (WJHTC) is the research arm of the FAA and supports its core mission areas of air traffic management, airport technology and aircraft safety. Among the many capabilities at the WJHTC, supporting aircraft safety initiatives is a major national resource: the Full-Scale Aircraft Structural Test Evaluation and Research (FASTER) facility is a state-of-the-art core capability developed to perform structural testing of legacy and next generation fuselage structures. Since its inception, the test fixture features a unique adaptation of mechanical, fluid, hydraulic, and electronic components capable of applying synchronous mechanical-temperature and humidity loading profiles which simulate the operational loads that fuselage structures are subjected to while in flight, Figure 1. Numerous test programs have been successfully completed through partnerships with other government agencies, industry and academia. The data obtained from the tests are used to analyze, calibrate and verify methods for fatigue and damage tolerance assessments.

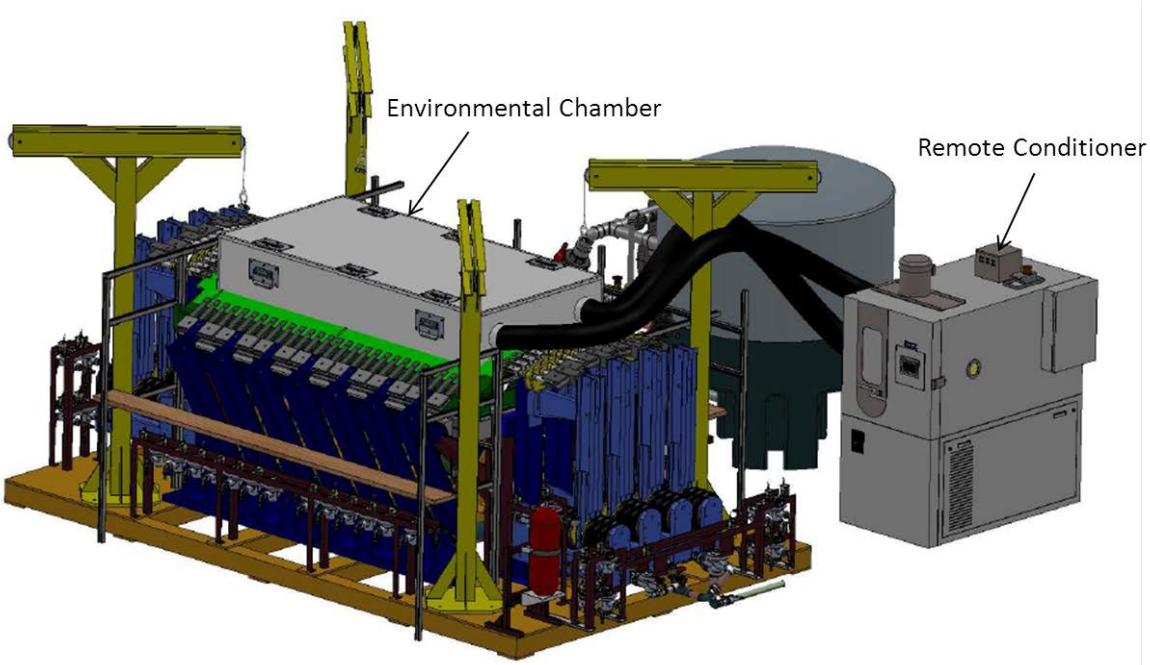

Figure 9 FAA's FASTER fixture for mechanical and environmental loading of fuselage panels.

In a joint effort, under a Cooperative Research and Development Agreement (CRDA) 07-CRDA-0236, the FAA and Boeing have been investigating the reliability and performance aspects of adhesive bonded technology through test and analysis of bonded repairs on metallic fuselage panels using the FASTER facility. To date, the focus has been on fuselage structure applications which are relatively thin and are subjected primarily to in-plane loads. Additional future efforts have been identified for bonded repairs of thicker structures such as primary beam component structure representative of typical wing and stabilizer components which are subjected to much more complex loads.

To further leverage resources and to take advantage of the experience and expertise of both Boeing and the FAA, the current CRDA will be extended to include bonded repairs to generic primary beam structures (metallic and composite). As a first step, Boeing and the FAA have partnered in establishing test capabilities at the WJHTC for beam structures. Moving towards that goal, Boeing has furnished over $500K worth of instrumentation and test equipment to the FAA.

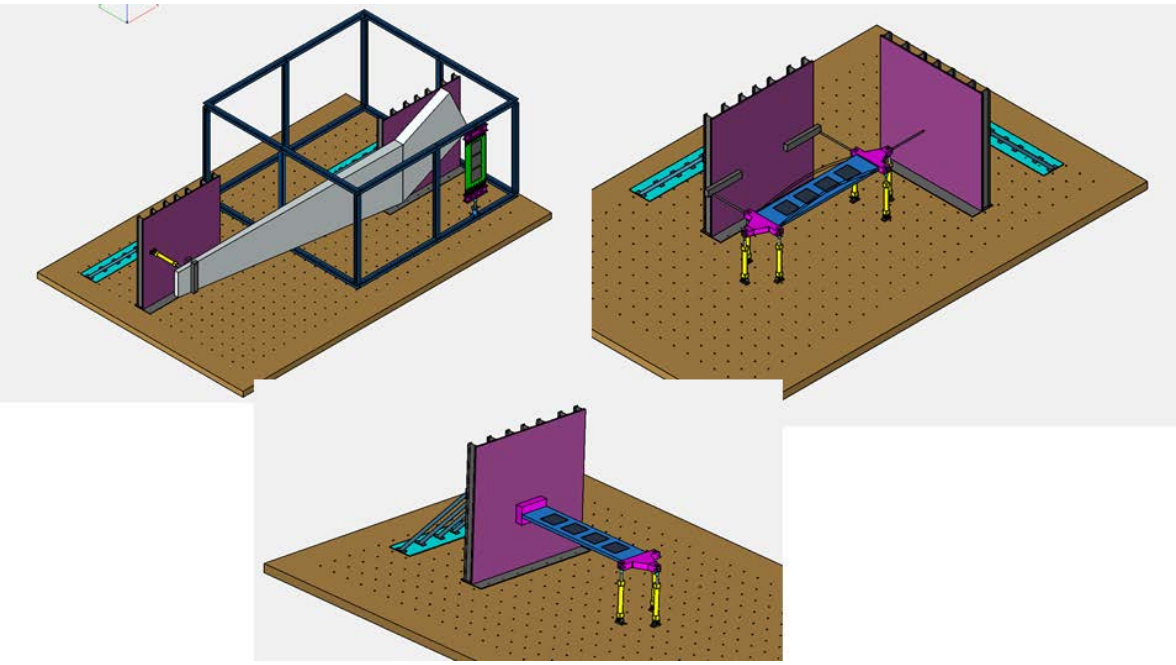

Figure 10 Beam fixture concepts using strongback.

11.Patent grant for Virtual Target Generator

During the initial stages of the Surveillance and Broadcast Services (SBS) Automated Dependent Surveillance-Broadcast (ADS-B) ground infrastructure roll-out, the FAA test team recognized the need for a safe and cost efficient way to conduct the multiple ADS-B equipped aircraft encounters required to exercise ADS-B systems and prepare for the upcoming ADS-B future application development and testing.

Richard Jennings (AIR-130) and Thomas Pagano (ANG-C33) conceived the idea of a virtual ADS-B target generator to help satisfy that requirement. Their concept was eventually patented under Patent No. 8,604,965 B2, Apparatus and Method to Generate and Detect Virtual Targets, reduced to practice, and its rights assigned to the Federal Aviation Administration on December 10, 2013. The FAA's Technology Transfer Program Office (TTPO; http://www.faa.gov/go/techtran) is currently investigating commercialization opportunities for the "Virtual Target Generator", and encourages FAA employees to participate in research and development innovation like the VTG that may result in intellectual property benefitting the United States economy, FAA, and flying public.

Figure 11 Virtual Target Generator.

12. Aircraft Geometric Height Measurement Element (AGHME)

The United States and global economies are heavily impacted by the ability of the FAA and the aviation industry to maintain safe and cost-effective transportation of people and cargo. Cooperative Research and Development Agreement (CRDA) No. 09-CRDA-0257 facilitates the research of new procedures that will result in significant airline industry savings, which can then be passed onto aviation users. The "AGHME" capability increases the number of flights that can fly at any given time and decreases the global problems of flight delays, congestion, and pollution.

Figure 12 AGHME rack containing a cooling unit, power supplies, network and maintenance components, main computer which houses the 1090MHz message decoding board set, and GPS unit

Figure 13 GPS and 1090MHz antennas on roof of William J Hughes Technical Center Federal Laboratory (WJHTC), Building #27

In-flight aircraft are required to maintain a minimum vertical separation, while at the same time, maintaining safety and security in the flight space. The Reduced Vertical Separation Minimum (RVSM) Program was developed to institute minimum separations in both the United States and abroad. A benefit of RVSM is cost per flight fuel burn savings, which are projected to be approximately $5.3 billion over the eleven year period between 2005 and 2016, with $393 million in savings in the first year increasing at a rate of 2% per year. This amounts to an approximate 2% savings for U.S. domestic air fleet operations. With the rise in jet fuel prices, the savings will exceed $13.4 billion; a 152% increase. Fuel burn savings are directly attributable to RVSM's improved routing, altitude selection, and delay reductions. FAA regulations and International Civil Aviation Organization (ICAO) treaties require aircraft and operators to be approved for participation in the RVSM program and, to this end, onboard altitude equipment must be verified as accurate. Continued joint work between the WJHTC and Diakon within the CRDA is necessary to complete development of the AGHME's capability and reach full commercialization potential.

13. Train Energy and Dynamics Simulator

The Federal Railroad Administration (FRA) has funded the development of a Train Energy and Dynamics Simulator (TEDS) computer program for conducting longitudinal train dynamics simulations. Longitudinal train dynamics affect several elements of train performance, including stopping distances, run-in/run-out forces, schedules and energy efficiency. An effective set of tools to study longitudinal train performance is therefore essential to the FRA's mission to improve the safety and performance of train operations. Such simulations offer invaluable opportunities for conducting safety and risk evaluations, energy consumption studies, incident investigations, and train operation studies. TEDS is a state-of-the-art software program designed and developed by the FRA, for studying and simulating train safety and performance.

TEDS can be used for a variety of studies, including:

- Incident investigations, energy consumption studies, and evaluation of operating rules
- Examining the impact of proposed speed limits on rail line capacity
- Evaluation of mixed equipment consists and operating practices on safety and efficiency
- Study of the effect of new equipment design on train operations
- Train handling parametric studies
- Developing Positive Train Control (PTC) braking algorithms
- Motive power optimization for trains and routes
- Safety evaluation of ECP braking systems on train operations

Recent Applications

TEDS has been used for several accident investigations, including:

- Lac-Mégantic – July 6, 2013
- Union Pacific train derailment, Colfax, CA – January 20, 2013
- Derailment at Ellicott City, MD – August 21, 2012
- Derailment of BNSF intermodal train, Doublea, AZ – April 7, 2012
- Derailment of long heavy UP train, Colton, CA – October 18, 2011
- Rear-end collision of BNSF coal train, Red Oak, IA – April 26, 2011

It has also been extensively used for the analysis of alternative braking arrangements to support Pipeline and Hazardous Materials Safety Administration's current rulemaking efforts related to trains carrying flammable, hazardous materials.

TEDS is currently being used by a small group of 'experts' that includes the FRA, National Transportation Safety Board, and Transport Canada, and some consultants/contractors that are supporting these agencies. This limited release has been successful with the users exercising multiple elements of TEDS for generating results that are critical to their application/study.