Research and Innovative Technology Administration

the VOLPE center

National Transportation Systems Center

HIGHLIGHTS

Cambridge, Massachusetts Jan/Feb 2006

Letter from the Director

New Office Directors Appointed

I am pleased to announce two new Volpe Center senior staff appointments as part of the Volpe Center's pending organizational restructuring. The Center's operational offices have been consolidated from five to three, each with a client-focused structure to promote organizational efficiency, effectiveness, and accountability. John O'Donnell, who led the Center's Office of System and Economic Assessment, is now Director of the Office of Surface Transportation Programs. This issue of *Highlights* introduces two new members of the Volpe Center management team: Nelson "Ned" Keeler, Director of the Office of Aviation Programs, and Kelly Leone, Director of the Office of Demonstration and Deployment Programs.

I heartily agree with RITA Administrator Ashok Kaveeshwar, who said, "the

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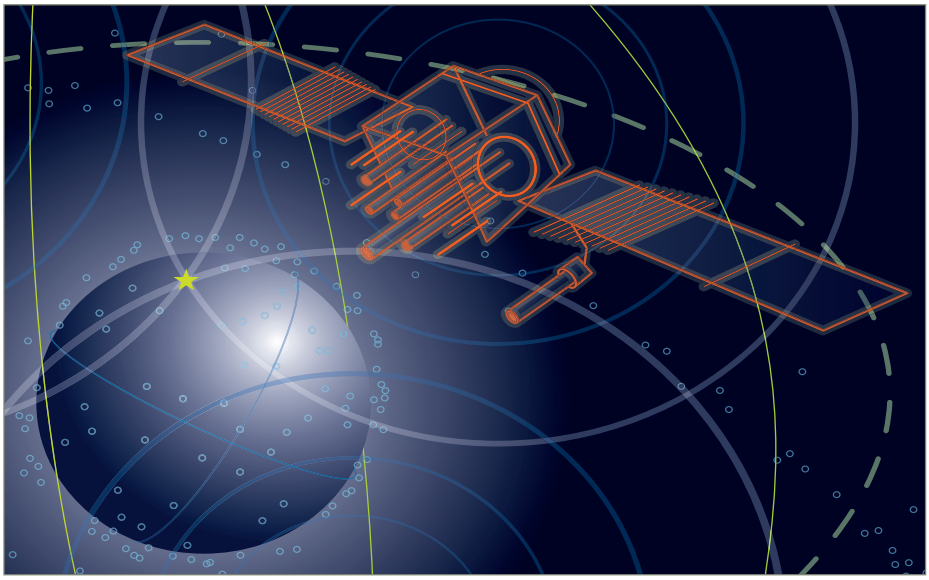


The Global Positioning System (GPS) consists of a minimum of 24 satellites, providing 24-hour, worldwide coverage. GPS can facilitate enhanced safety, improved service levels, heightened security, and greater efficiency. However, the complexities of ensuring its reliability necessitate innovative yet practical approaches to developing and implementing policy, regulations and standards, and technology. The Volpe Center, with expertise in all of these arenas, can help ensure that GPS fulfills its promise for improving almost every mode of transportation.

Volpe Center Provides Leading Edge GPS Expertise for Transportation

The Global Positioning System (GPS)—which provides extremely accurate and continuous three-dimensional positioning, navigation, and timing information to users worldwide—is proving to be an indispensable tool across the transportation enterprise. Deployed and operated by the U.S. Department of Defense (DoD), this satellite-based radionavigation system has become critical for both military and civilian applications. DOT works closely with DoD in coordinating the civil capabilities of GPS. The Volpe Center has been involved in GPS activities since the mid-1980s, playing important roles—in supporting policy development, including the critical task of determining the reliability and vulnerability of GPS; in developing GPS applications for all modes of transportation; and in supporting international standardization efforts, as well as working with other

agencies to support the modernization of GPS, particularly for civil use. This rich legacy of experience in the GPS arena enables the Center to take a leadership role in determining the future of navigation systems.

GPS Policy—the Center's Research and Coordination Role

Federal Radionavigation Plan

The Volpe Center develops the Federal Radionavigation Plan (FRP) under the sponsorship of DoD, DOT, and the Department of Homeland Security (DHS). The recently published 2005 edition focuses on a transition to GPS-based services, recognizing the need to maintain backup navigation aids and provide redundant systems. The plan is the official source of radionavigation policy and planning for the federal government and covers common-use, federally operated radionavigation systems—systems used by both civil and military sectors. The plan contains the current policy on the mix of radionavigation systems, and presents the federal interagency approach to the implementation and operation of radionavigation systems. It also addresses the needs of civil users beyond aviation and marine areas, and discusses GPS applications for land vehicles, surveying and mapping, weather research, space applications, and many other uses. (Systems used exclusively by the military are covered in the Master Positioning, Navigation, and Timing Plan published by the Joint Chiefs of Staff.)

Vulnerability of Transportation Infrastructure Relying on Global Positioning System

In the mid-1990s, GPS was planned to be the sole source of radionavigation for aircraft guidance systems by 2010. However, the Presidential Commission on Critical Infrastructure Protection recognized that using GPS alone would create the potential for a single source of failure. There was a broad realization that when GPS is used in a safety-of-life application, vulnerability issues must be addressed. As a result, DOT, in consultation with DoD, undertook a thorough evaluation of the national transportation infrastructure that relies on GPS to address the vulnerability of the system and to ensure that civil transportation systems are not entirely dependent on any one technology. In a highly regarded and influential study, the Volpe Center assessed the vulnerability of civil-transportation GPS applications and recommended appropriate mitigation techniques in critical applications wherever possible. The results of the study were published in a 2001 report titled *Vulnerability Assessment of the Transportation Infrastructure Relying on the Global Positioning System.*

This report identified transportation operations that employ GPS, methods for GPS disruption, possible impacts to transportation safety, and mitigation approaches to ensure service reliability. All modes of transportation are increasingly reliant on GPS and, according to the report, GPS is sus-

"GPS offers us the capability to improve our quality of life through application across almost every mode of transportation. However, the transition to GPS from current systems and the determination of what part of the current radionavigation infrastructure to retain is a complex matter involving government, industry, and users. We are seeking a sensible transition to satellite-based navigation services as our primary means of navigation, while recognizing the need to maintain backup navigation aids where required."

— DOT Secretary
Norman Y. Mineta

ceptible to various forms of intentional and unintentional interference. Unintentional disruption can result from such causes as atmospheric effects, signal blockage from buildings, and interference from communications equipment. Because of the pervasive use of GPS, intentional disruption can range from terrorist attacks to people simply trying to avoid road tolls to libertarian resistance to the perception that citizens' movements can be tracked.

A number of recommendations to address the possibility of disruption and ensure the safety of the national transportation infrastructure were presented in the report. The DOT operating administrations, having conducted a thorough review of the Volpe Center study, declared that they concur with all of the report recommendations. As announced in March 2002, DOT is implementing a GPS Action Plan that includes the following initiatives for maintaining the viability of the nation's transportation infrastructure:

- Ensure that adequate GPS backup systems are maintained
- Maintain the partnership with DoD to continue modernizing GPS with the implementation of new civil signals
- Facilitate transfer of appropriate GPS anti-jam technology from the military for civil use
- Conduct industry outreach to develop GPS receiver performance standards
- Emphasize and promote education programs with state and local departments of transportation that advise users about GPS vulnerabilities
- Assess radionavigation capabilities across all the modes of transportation to identify the most appropriate mix of systems, from both a capabilities and cost perspective, for the next 10 years and beyond. This will include completing the evaluation of the long-term need for the continuation of Loran-C.

GPS Modernization—RITA's Role

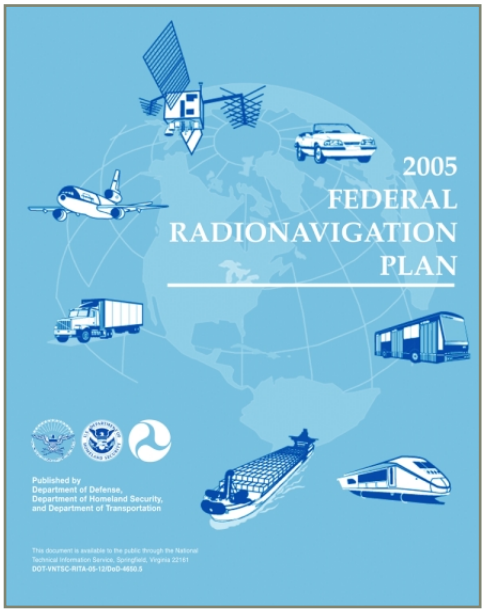
The next-generation of GPS, known as GPS III, is being designed to meet military and civilian needs through at least 2030. The goals of the GPS modernization program are to protect the service for U.S. and allied forces and prevent adversary exploitation, and to preserve civil use and provide enhancements. GPS III will eliminate some system shortcomings and vulnerabilities. The new system is currently in the development-definition phase, where system architecture is designed and requirements are identified and documented.

The Volpe Center works closely with the Civil Applications Program Manager at the GPS Joint Program Office to help capture the needs of the

GPS Action Plan

"The action plan... will ensure that the vulnerabilities identified in the (Volpe) report do not affect the safety and security of our transportation system as we work to ensure that GPS fulfills its potential."

— DOT Secretary
Norman Y. Mineta



Volpe Center GPS Reports
Available at www.navcen.uscg.gov/
- *2005 Federal Radionavigation Plan*
- *Vulnerability Assessment of the Transportation Infrastructure Relying on the Global Positioning System*

civil community for GPS III. One current effort is particularly significant—developing and maintaining an integrated database of requirements and establishing the relationships and traceability of requirements within the GPS system. This effort will equip the civil GPS community with the information necessary for informed decisionmaking. GPS III will enhance U.S. leadership in space navigation and help to meet the presidential goal of establishing GPS as a world standard.

Development of a National Positioning, Navigation, and Timing (PNT) Architecture – RITA's Role

The new National Security Policy Directive (NSPD-39) reaffirms the open use of GPS civil signals and unrestricted access to the technical information that is needed to manufacture equipment using those signals. DoD will maintain the primary responsibility for developing and modernizing GPS. However, identifying, specifying, and funding new civil capabilities will be the primary responsibility of DOT.

The National Space-based Position, Navigation, and Timing (PNT) Executive Committee (NPEC), co-chaired by the secretaries of defense and transportation, will develop a Five-Year National Space-based PNT plan, which will include architecture specifications. On behalf of DOT, the Research and Innovative Technology Administration (RITA, the Volpe Center's parent agency), will lead the national PNT architecture effort and will provide input on the requirements and perspectives of the civil community.

The approach for the National PNT Architecture effort is to help guide future PNT system-of-systems investment and implementation decisions. The objective is to provide more effective and efficient PNT capabilities in the post-2025 timeframe and an evolutionary path for government-provided PNT systems and services. This effort will document the current national PNT architecture and evaluate alternative future mixes of global (space and non space-based) and regional PNT solutions, PNT augmentations, and autonomous PNT capabilities to address priorities identified by both the civil and military communities.

Volpe Center's GPS Work Across the Transportation Modes

Aviation—Predicting the Availability of Navigation Service with Integrity Monitoring

For many reasons, no single navigation system is reliable all of the time. It is, therefore, important that users have a means to be informed of system failures. The integrity of a system is defined by its ability to provide a timely warning when it fails to meet its stated accuracy and should no longer be used. GPS itself cannot provide integrity monitoring that satisfies aviation requirements. Receiver Autonomous Integrity Monitoring (RAIM)

Selected Volpe Center GPS Projects

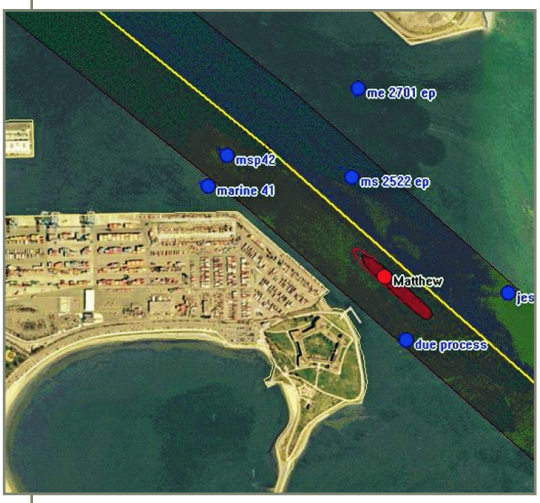
- *Federal Radionavigation Plan*
- *GPS Vulnerability Report*
- *GPS coverage models and outage reporting systems for civilian and military aviators*
- *GPS integrity monitoring algorithms for aviation*
- *GPS interference investigation and development of detection methods and mitigation techniques*
- *Vessel tracking and navigation in harbors and waterways*
- *Human factors studies of GPS applications*
- *Intelligent Transportation Systems*
- *Positive Train Control*
- *Hazardous materials tracking*
- *Security and asset protection in support of military operations*

currently provides integrity monitoring within certified aviation receivers. RAIM is a method that examines the internal consistency of a set of redundant measurements within the GPS receiver to detect, and perhaps remove, a faulty measurement. In the case of GPS, this amounts to detecting, and perhaps excluding, a faulty satellite from the set used for navigation. When GPS is used as a supplemental navigation system, fault detection is all that is required. When GPS is used as a primary means of navigation, both fault detection and fault exclusion are required. The Volpe Center has supported the Federal Aviation Administration (FAA) in developing integrity algorithms as well as studying coverage and availability of RAIM and Fault Detection and Exclusion for all phases of flight, from oceanic through nonprecision approach.

The Center's recent work in this area also includes contributing to FAA's Wide Area Augmentation System (WAAS). Because GPS alone does not meet FAA's navigation requirements for accuracy, integrity, and availability, WAAS was developed for use in en route applications through approach with vertical guidance. WAAS uses a series of ground reference stations to correct for GPS signal errors caused by ionospheric disturbances, satellite timing, and orbit errors, and it provides integrity information on each GPS satellite. The Volpe Center has supported augmentations to WAAS, and has also evaluated integrity and continuity for FAA's Local Area Augmentation System (LAAS), an augmentation to GPS for service in airport areas (approximately a 20-30 mile radius).

DOT and the DoD are also engaged in a project to identify specific potential failures that would compromise GPS integrity. In support of the Integrity Failure Modes and Effects Analysis Project, the Volpe Center analyzes integrity anomalies that are caused by hardware and software failures in the GPS satellites and/or operational control segment.

For the Saint Lawrence Seaway, the Volpe Center established the first fully operational Automatic Identification System (AIS) network in North America.



Leveraging existing tracking technology developed to improve safety and efficiency in the Panama Canal and Saint Lawrence Seaway, the Volpe Center designed, tested, and deployed the Vessel Identification and Positioning System (VIPS) to improve maritime security and asset protection. U.S. security, operations, and force protection units can track all VIPS-equipped vessels in real time on a geographic display.

Marine Navigation—Central America and the Saint Lawrence Seaway

When large cargo ships traverse narrow waterways, the careful management and navigation of their passage is critical to maximizing efficiency, safety, and security. The Volpe Center has developed several systems that improve vessel tracking in shipping channels using GPS and other technologies. Between 1996 and 2000, the Center installed a state-of-the-art navigation system in the Panama Canal. Subsequently, smaller-scale systems were installed in Central American ports to restore navigation capabilities that were destroyed by hurricanes. In 2002, the Center designed and implemented a comprehensive vessel communications and tracking network that identifies and tracks commercial vessels on the Saint Lawrence Seaway.

The network, based on Automatic Identification System (AIS) technology, provides signal coverage from Montreal to eastern Lake Erie. Developed by

the Volpe Center, AIS integrates global positioning technology with communications data links to provide vital and precise information on ship identification, position, speed, and heading to a vessel traffic control center as well as to other AIS-equipped ships. It also provides data on weather, wind, current, and water and ice levels. Volpe also installed an AIS system for the Columbia River Pilots Association.

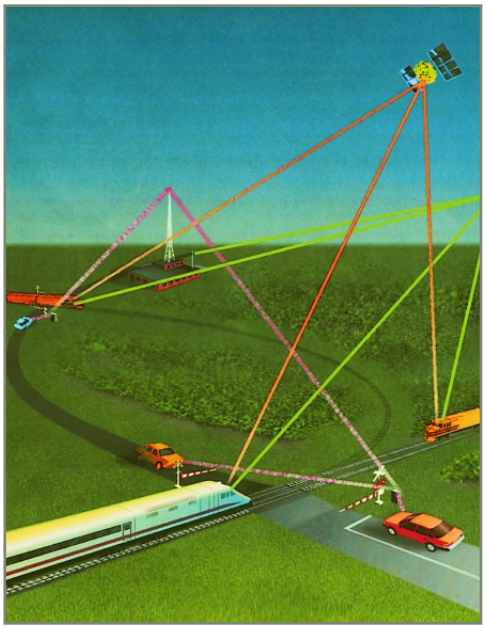
AIS offers a range of benefits: system administrators can schedule inspections and services in a more timely manner, effect better speed control, and schedule lockages and vessel tie-ups more efficiently; as transit times are reduced, shippers improve fleet management and save on fuel; and in a time of heightened security, law enforcement officials can respond more quickly and effectively to emergencies.

Rail—Improving Safety and Mobility with Positive Train Control

Over the next decade, global positioning and navigation services will become increasingly important to railroad operations. The Federal Railroad Administration (FRA) is encouraging and facilitating the accelerated adoption of sensors, computers, and digital communications to collect, process, and disseminate information to improve the safety, security, and operational effectiveness of railroads. Elements of this approach require accurate, real-time information about the location of railroad equipment.

The use of GPS is part of a larger effort within the railroad industry seeking to develop an integrated command, control, communications, and information system for controlling train movements with safety, security, precision, and efficiency. Positive Train Control (PTC) systems being planned, or currently under pilot-project study, will improve railroad safety by virtually eliminating the risk of: collisions between trains, casualties to roadway workers, damage to equipment, and over-speed accidents. With extensive experience working with GPS applications in air and marine navigation, the Volpe Center has the technical expertise to support this effort, and has demonstrated this capability by developing a mobile tracking system that uses a GPS-based position-reporting system to provide accurate location information for off-track vehicles at the FRA's Transportation Technology Center in Pueblo, Colorado.

FRA, along with other government agencies, is performing research to assess the feasibility of improving the accuracy of the Nationwide Differential Global Positioning System (NDGPS), within the confines of the existing infrastructure, for civilian land applications. NDGPS uses ground reference stations to determine the differential between the GPS location and the true location. Enabling high-accuracy NDGPS options will require additional data rate capabilities. The Volpe Center has been actively



Intelligent Railroad Systems using GPS could increase safety at highway-rail intersections. Processor-based control systems and digital communications could enable reliable and timely communication between rail and highway systems, and to passenger vehicles near crossings.

working with FRA to investigate error-mitigation techniques for atmospheric errors (troposphere and ionosphere), multipath, and clock and orbital errors to achieve the desired accuracy of 20-40 cm from the high-accuracy DGPS architecture. Some of these techniques are similar to those under development by the FAA, such as the LAAS, and the WAAS (described above in the Aviation section). Research also is needed to achieve other performance parameters for these systems, such as integrity, availability, and continuity.

Transit—Advanced Vehicle Location Systems

Many transit systems across the country now use Advanced Vehicle Location (AVL) systems that depend on GPS to track buses and ensure accurate schedule performance, increase overall operating efficiency, and assist in fleet management. The Volpe Center's established role as an impartial evaluator of new methods and technologies, together with its understanding of those technologies, enabled a Center team to develop a set of Advanced Public Transit Systems Evaluation Guidelines that provide a common framework and methodology for evaluating individual operational tests.

International GPS Efforts

The Volpe Center is working with the International Civil Aviation Organization to better integrate operation of the global positioning satellite navigation system. These efforts have not only increased recognition of the Center's GPS capabilities, but have offered opportunities for other countries to capitalize on advances in GPS transportation applications and thus to increase safety and efficiency and facilitate trade. The Center is examining the potential improvements to aviation that the introduction of the Russian Global Navigation Satellite System (GLONASS) and the European GALILEO system could bring in conjunction with the use of GPS.

In addition, the Center supports individual countries in the introduction and operation of GPS systems. Examples of the Center's work in this area include support to:

- The Canadian Civil Air Navigation Services (NAV CANADA) in the integration of a WAAS service volume model with the Canadian Notice to Airmen (NOTAM) system for predicting and reporting outages
- Air Service Australia's Automatic Dependent Surveillance Broadcast (ADS-B) GPS RAIM Prediction System, which provides the capability to distribute GPS outage information
- Brazil's Department of Air Space Control (DECEA) in developing and deploying the first real-time GNSS performance monitoring capability for operational use. The system will be able to monitor the operational status of a GNSS system in real time, as well as predict its future performance.

Complementary Navigation Systems—Integrating Loran and GPS

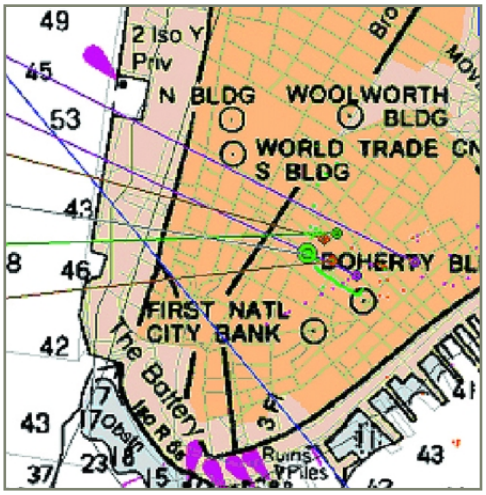
The Volpe Center is working with FAA to validate whether the complementary positioning and timing features of Loran (LOng RAnge Navigation) and GPS can meld into a tracking system that maintains radionavigation performance standards in the urban and maritime environments. Specifically, a recent Volpe Center study assessed the extension of technologies that the Center has applied in aviation and marine navigation for land applications in urban areas, using positioning and timing information provided by an integrated GPS/Loran system. The original Loran-C is nearing completion of a significant upgrade and enhancement effort funded by FAA. Enhanced Loran complements the GPS system well. Loran is a navigation system that uses the time interval between radio signals received from two or more radio transmitters to determine the position of a ship or aircraft. It was originally developed to provide radionavigation service for U.S. coastal waters and was later expanded to include complete coverage of the continental United States as well as most of Alaska. Its signals are much less susceptible to the interference that can impair GPS, and its broadcast frequency has minimal line-of-sight issues. Loran has recently been shown to be an adequate backup system to GPS for many applications.

The Volpe Center's work examines how well the integrated GPS/Loran system can supplement GPS when the GPS signal is not usable. As part of this effort, Volpe staff conducted performance evaluations in the Boston and New York City areas, and under GPS-band jamming in New Mexico. Preliminary conclusions are that Loran can be a valuable surveillance supplement to GPS in some urban applications.

Because GPS is used to synchronize network timing, its disruption can potentially impact wide-ranging infrastructures such as finance and banking. In general, it is thought that Loran can be used to augment GPS because it provides the necessary timing backup. However, as Loran is not an international system, it does not provide a global solution.

GPS and the Future of Transportation

The uses of GPS in the transportation arena are already numerous, and future applications are wide-ranging. In aviation GPS already supports oceanic, enroute, terminal, and vertical guidance and may be used in the future for airport surface management. Maritime, land, and aviation applications will be enhanced by improvements to the accuracy and integrity of GPS. Highway applications today are focused on assisting travelers in determining their routes and in fleet management. Near-term research is underway to examine the ability to provide warnings to drivers of potential critical situations, such as a stop sign violation or to avoid crashes. In the trucking industry GPS can be used to monitor compliance with hours-of-service regulations. Applications in the transit industry include expanding



Volpe Center study of integrated Loran/GPS. This figure shows how blockage of navigation signals in New York City's Wall Street area "urban canyon" produces various estimates of the same vehicle's position (depicted by circles). All fixes but one are too inaccurate at the instant shown to locate the vehicle correctly. The one exception is the Dead Reckoning solution—the green dot—but Dead Reckoning also degrades unacceptably after further exposure to this environment.

fleet-tracking capabilities. GPS-based position determination is also used to determine passenger-vehicle position for emergency response; this use will increase. In summary, GPS can facilitate enhanced safety, improved service levels, heightened security, and greater efficiency. However, the complexities of ensuring its reliability necessitate innovative, yet practical approaches, to developing and implementing policy, regulations and standards, and technology. The Volpe Center offers expertise in all of these arenas and can help ensure that the use of GPS fulfills its promise.

Highway-Rail Grade Crossings—Research and Results (FRA)

Over a 30-year history of grade crossing research, Volpe Center researchers have worked to develop a more precise understanding of risks to highway and rail users at grade crossings and then determine how best to decrease or eliminate various risk elements. Research results are shared in a variety of ways, from conference presentations to transfer of prototype technology to the private sector for full implementation. Examples of recent work for the Federal Railroad Administration (FRA) are described below.

National Highway-Rail Grade Crossing Safety Training Conference

Several Volpe Center staff members participated and presented papers at the 2005 National Highway-Rail Grade Crossing Safety Training Conference held in Austin, Texas, November 6–9, 2005, where grade crossing safety experts gathered to discuss the latest thinking, innovations, and technologies in grade crossing safety. In addition, Ms. Anya Carroll of the Railroad Systems Division was an active member of the organizing committee for the past year and coordinated the following sessions: Understanding and Developing Guidance on Pedestrian Crossings; Pedestrian Access, Grade Separations and Compliance Issues; and Collision Avoidance Systems. Summaries of Volpe Center presentations are provided below; they describe work sponsored by the FRA Offices of Research & Development, Railroad Development, and Safety.

- **"Use of New Technologies for Highway-Rail Intersections and Train Control,"** by Mr. Steven Peck of the Railroad Systems Division, summarized the salient changes that are taking place that affect highway-rail intersections. Such factors as faster trains, increased freight traffic, and more driver distractions necessitate an increased focus on the application of modern technologies and practices designed to address the problems and to improve safety at highway-rail intersections. The presentation described a wide array of technologies, presented some operational examples, and summarized the key areas where the Volpe Center is able to support the FRA.

- **"Connecticut Four-Quadrant Gate Crossing with Vehicle Detection and In-Cab Signaling,"** by Mr. Adrian Hellman of the Railroad Systems Division, described the history, purpose, goal, and background of the demonstration project for four-quadrant gate technology along Amtrak's Northeast High-Speed Rail Corridor in Groton, Connecticut. The operational characteristics, system functionality, and collision-avoidance approach of the system were presented as well as a description of Volpe Center's evaluation program. Mr. Hellman concluded that video monitoring is an effective tool, violation rates were reduced significantly, and that an obstruction-detection system was successful.
- **"PEERS Project: Public Education and Enforcement Research Study,"** by Ms. Suzanne Sposato of the Railroad Systems Division, described the PEERS project, which entailed researching the effectiveness of methods and technologies designed to reduce the incidents, fatalities, and injuries at highway-rail intersections. Highway-rail intersections at three locations in Illinois were monitored before, during, and after education and enforcement campaigns. The study goals were to provide research data on the effectiveness of education and enforcement measures. This data will be used to support the FRA's future rule-making activities. Preliminary results showed that highway-user behavior became safer as a result of interventions used in the PEERS project.
- **"State of the Art Technologies for Intrusion/Obstacle Detection,"** presented by Mr. Marco daSilva of the Advanced Safety and Technology Division and co-authored by Ms. Anya Carroll of the Railroad Systems Division and Mr. William Baron of the Infrastructure Protection and Operations Division, provided an extensive survey of obstacle and intrusion technologies for rail rights-of-way and crossings and recommended potential technology concepts for future field testing.
- **"Railroad Infrastructure Trespass Detection Research,"** presented by Mr. Marco daSilva of the Advanced Safety and Technology Division and co-authored by Ms. Anya Carroll of the Railroad Systems Division and Mr. William Baron of the Infrastructure Protection and Operations Division, described a study performed by the Volpe Center to demonstrate a video-based trespass monitoring and deterrent system developed from commercial of-the-shelf technology. The system was successfully transferred to a private company upon completion of the evaluation (see below).

Rail Trespass-Detection System Transferred to Private Sector

Exemplifying its ability to integrate innovative technologies for practical application, the Volpe Center recently transferred an automated trespass-monitoring-and-deterrent system to the CSX Corporation in Albany, New York, for full implementation. This video-based system is capable of detecting intrusions on railroad rights-of-way. Under FRA sponsorship, a Volpe Center team, led by Mr. Marco DaSilva of the Railroad Systems Division, developed the prototype and completed a three-year evaluation of the Trespass Detection System at a CSX railroad bridge in Pittsford, New York,

Rail Trespass-Detection System. Rail trespassing poses a major safety risk to rail passengers and employees as well as to trespassers—yet the temptation for people to cross railroad tracks or bridges remains strong. The Volpe Center developed and evaluated a rail trespass-detection system that was recently transferred to the private sector for full implementation. The video-based system detects trespassers and warns them with a real-time acoustic message and/or dispatches law enforcement. Shown above: top, two teenage trespassers leaving the tracks after receiving a real-time acoustic warning; bottom, a freight train at the same location one minute after the trespassers left.

where trespassing is commonplace and fatalities have occurred. The interactive system comprises off-the-shelf technology, including video cameras, motion detectors, infrared illuminators, speakers, and central processing units. Results of the demonstration project indicate that the Trespass Detection System performed successfully and that it can serve as a model security system for railroad infrastructure.

Sharing ITS Knowledge

The Volpe Center has been at the vanguard of research, development, and deployment of Intelligent Transport Systems (ITS) for more than 20 years. Center staff members apply diverse expertise to help DOT achieve the full potential of ITS to reduce congestion, enhance safety, mitigate the environmental impacts of transportation systems, enhance energy performance, and improve productivity. The Center's experience includes identifying obstacles to ITS deployment and their resolutions at national, state, and local levels; supporting the DOT's ITS Professional Capacity Building Program; developing strategies to promote use of the national ITS architecture and ITS standards; incorporating ITS improvements into regional planning methods; assessing and deploying traveler information systems; and facilitating the exchange of ITS knowledge at international levels. Several Volpe Center staff members exemplified the Center's comprehensive expertise at the 12th World Congress on ITS in San Francisco, California, November 6–10, 2005.

- **ITS and Catastrophic Events.** The Volpe Center conducted six case studies for the DOT's ITS Joint Program Office on the effects of catastrophic events on transportation systems. In each case, portions of the installed ITS suffered damage or failed during the event. Mr. Allan DeBlasio of the Planning and Policy Analysis Division presented "Lessons Learned about ITS Technologies from a Series of Studies on Catastrophic Events and Transportation System Management." He described the kinds of problems encountered, highlighted the need for ITS during and after an emergency, and offered a summary of lessons learned from the case studies, including measures that agency management and staff can take to minimize disruption in service.
- **Determining Driver Satisfaction.** Also for the ITS Joint Program Office, the Volpe Center conducted a before-and-after customer satisfaction survey of drivers on an urban arterial roadway treated with an adaptive traffic signal system. (Adaptive signal timing automatically adjusts signal timings in real-time based on current traffic conditions.) The objective of the study was to develop and test a methodology for measuring customer satisfaction with roadway quality, and to provide reliable data on whether the adaptive signal system resulted in increased driver satisfac-

tion along the study route. The study findings attest to the robustness of the method developed to measure driver satisfaction with their roadway experience. However, the study did not find an increase in driver satisfaction resulting from the adaptive signal system. Ms. Margaret Petrella of the Economic and Industry Analysis Division presented "Driver Satisfaction with an Urban Arterial after Installation of an Adaptive Signal System," detailing the study method and results.

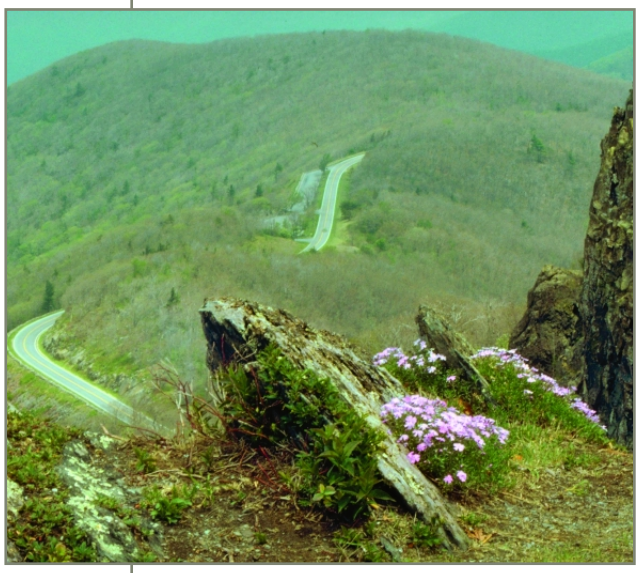
- **The Future of ITS Professional Capacity Building.** For several years, the Volpe Center has supported the DOT's ITS Professional Capacity Building (PCB) Program. In a presentation titled "Reinventing Workforce Capacity Building Strategies in ITS—Creating a New Dynamic for Continuous Learning," co-authors Mr. Ron Giguere, ITS PCB Program Coordinator, and Ms. Suzanne Sloan of the Volpe Center's Service and Operations Assessment Division summarized how the ITS PCB Program will address the ITS-related learning requirements of transportation practitioners over the next five years. The program recognizes that each practitioner has different needs at different times, and that they all need better access to learning opportunities that enable them to build the necessary knowledge and skills. The ITS PCB Program intends to meet this challenge by further expanding delivery methods beyond the conventional classroom-training model. Training content must also be repackaged into directly accessible learning tools, and integrated with technical assistance resources so that ITS practitioners can find the right combination of resources where and when they need them.
- **Metropolitan Transit ITS Adoption in the United States.** Ms. Sari Radin of the Economic and Industry Analysis Division presented "Metropolitan Transit ITS Adoption in the United States," describing a survey of urban transit agencies designed to determine what Advanced Public Transport Systems or ITS technologies these agencies have deployed or plan to deploy. This summary is designed to be useful to both government agencies and the private sector. It provides an overview of the current deployment and reflects possible interest in additional purchase of technology systems. Data that was collected during the summer and fall of 2004 through an Internet survey is compared to that collected in similar surveys in previous years.
- **International Workshops.** Ms. Jane Lappin of the Economic and Industry Analysis Division, in her role as chairman of the ITS International Benefits, Evaluation, and Costs (IBEC) Working Group, produced a one-day workshop titled "An International Tour of ITS Costs, Evaluations, and Benefits," as part of the ITS America conference. IBEC is an international working group for the ITS community that facilitates the exchange of information and techniques used to evaluate the costs and benefits of ITS throughout the world. This workshop provided ITS program managers and evaluators from the United States, Scotland, New Zealand, the Netherlands, Slovakia, Denmark, Switzerland, Turkey, Ireland, Italy, Belgium, France, Germany, and the United Kingdom with an opportunity to present lessons learned, discussing their successes, failures, and future plans for achieving their

program goals. As part of that workshop, Ms. Lappin chaired sessions on vehicle-infrastructure integration and traveler information services, and Ms. Leisa Moniz, of the Infrastructure Protection and Operations Division, organized a panel of international experts addressing electronic fee payment. Further, Ms. Lappin chaired a special session on the issues related to the introduction of ITS in developing countries and economies in transition. Ms. Lappin also participated in an international workshop on the future of urban transport organized by Transport for London.

Environmental Stewardship

Alternative Transportation Planning for Shenandoah National Park (NPS)

Congestion in many national parks causes lengthy traffic delays and noise and air pollution that substantially detract from the visitor experience and overall resource protection. Accordingly, the National Park Service (NPS) has been exploring the use of innovative, sustainable, and appropriate alternative transportation solutions. Since 2000, the Volpe Center has supported the NPS alternative transportation planning process. A significant part of this effort has focused on producing alternative transportation plans for selected national parks. Recently, the Center delivered the *Shenandoah Alternative Transportation Planning Study* to the NPS.



Shenandoah National Park. The NPS is charged with a dual mission: to protect the extraordinary sites in its care while providing for public access and enjoyment. The Volpe Center helps NPS plan and develop alternative transportation systems that can help protect valuable resources while enhancing the visitor experience. A recent report addresses transportation issues at Shenandoah National Park, which offers spectacular views of the Blue Ridge Mountains and is one of the most visited national parks. (Photo courtesy of National Park Service, Digital Image Archives)

Shenandoah National Park in Virginia is one of the most visited parks in the NPS system. The Volpe Center's report addresses several transportation issues at the park, including: reassessing traveler information services that are available to park visitors; assessing potential improvements to enhance accessibility to Skyline Drive scenic overlooks; identifying and reviewing available transportation data that can be used for future park planning; options for replacement of a tour vehicle for the Rapidan Camp area of the park; and providing an overview of the socioeconomic conditions and trends in the Shenandoah Valley region that may potentially influence current and future park visitation.

The Volpe Center team that developed the report includes Mr. Robert Armstrong of the Motor Carrier Safety Assessment Division; Mr. Eric Plosky, Mr. David Spiller, and Ms. Frances Fisher of the Service and Operations Assessment Division; Mr. Carson Poe of the Planning and Policy Analysis Division; and Mr. Garth Brazelton of the Economic and Industry Analysis Division.

This final report is available at *www.volpe.dot.gov/nps/shenandoah.html*.

Security

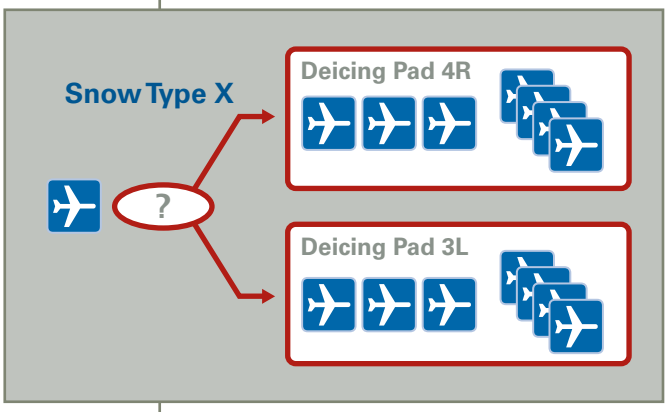
Quality Assurance in Airport Screener Training Program (TSA)

The Transportation Security Administration's (TSA) Quality Assurance (QA) Branch is responsible for monitoring, evaluating, analyzing, and reporting on the effectiveness, efficiency, and adequacy of airport screener training programs. Staff members of the Volpe Center with expertise in QA and training have supported TSA's QA Branch regarding its National Screener Training Quality Assurance Program, including performing an overall assessment of the program.

Volpe Center staff members were trained and certified as QA monitors and then deployed throughout the country to observe screener training sessions, evaluate the delivery and effectiveness of screener training and recertification, and verify that course offerings are being delivered in a standard format consistent with TSA policy. In addition, based on 28 site visits, stakeholder interviews, and an industry benchmarking analysis, the Volpe Center provided TSA with a current-state analysis of the QA program. Volpe Center team members include Mr. Kip Brown, Acting Chief of the Telecommunications Division, and Dr. Sylvia Harris, Mr. David Roane, Ms. Justyne Johnson, Ms. Christine Risko, and Ms. Sharon Jenkins, also of the Division.

Published & Presented

- **DTW De-Icing Model.** Mr. Chris Daskalakis of the Surveillance and Assessment Division presented "Validation of the DTW De-Icing Model," at the 24th Digital Avionics Systems Conference held in Washington, DC, October 30–November 3, 2005. The presentation was co-authored by Ms. Suzanne Chen and Dr. Jonathan Lee of the Division.
- **Rail Equipment Research Presented at ASME Conference.** Several Volpe Center staff members presented papers in the technical sessions on rail transportation at the American Society of Mechanical Engineers (ASME) International Mechanical Engineering Congress and Exhibition in Orlando, Florida, November 5–11, 2005. The papers reflect Volpe Center expertise in the areas of rail equipment crashworthiness, rail equipment integrity research, and rail equipment glazing research. The papers are listed below: abstracts are available on ASME's website, *www.asme.org*, and full text of the first three papers listed is available at *www.volpe.dot.gov/sdd/pubs.html*.
  - "Crashworthiness Requirements for Commuter Rail Passenger Seats," by Ms. Kristine Severson and Mr. David Tyrell of the Structures and Dynamics Division, and Mr. Robert Rancatore of TIAX LLC. (IMECE2005-82643)
  - "Design of a Workstation Table with Improved Crashworthiness Performance," by Mr. Daniel Parent and Mr. David Tyrell of the Structures and Dynamics Division,



DTW De-Icing Model. To decrease the impact of snow and ice on air carrier and airport operations, a Volpe Center team developed and demonstrated a de-icing model at Detroit Metro Airport. This decision-support tool helps personnel select the appropriate de-icing pad for each outbound aircraft, given the current conditions and types of aircraft at the respective de-icing pads, to minimize total time in queue and at the stations. The demonstration project showed that the tool can help maximize predictability, minimize operating cost, and reduce environmental impact.

Mr. Robert Rancatore of TIAX LLC, and Dr. A. Benjamin Perlman of Tufts University. (IMECE2005-82779)

- "A Crush Zone Design for an Existing Passenger Rail Cab Car," by Mr. Eloy Martinez and Mr. David Tyrell of the Structures and Dynamics Division; Mr. Robert Rancatore and Dr. Richard Stringfellow of TIAX LLC; and Mr. Gabriel Amar of Taylor, Raynauld, Amar & Associates. (IMECE2005-82769)
- "Impact Resistance of Rail Vehicle Window Glazing and Related Safety Issues," by Mr. James Lamond of the Railroad Systems Division, Dr. Thomas Tsai of the Federal Railroad Administration, and Mr. Sam Liao of Parsons Brinckerhoff Quade & Douglas, Inc. (IMECE2005-83064)
- "Development of a Passenger Wheel Standard," by Mr. Jeffrey Gordon of the Structures and Dynamics Division and Mr. Dan Stone of Hunter Holiday Consulting. (IMECE2005-82790)
- "Fatigue Performance of AAR Class A Railroad Wheel Steel at Ambient and Elevated Temperatures," by Mr. Jeffrey Gordon of the Structures and Dynamics Division and Mr. Fraser J. McMaster and Mr. Guadalupe B. Robledo of Southwest Research Institute. (IMECE2005-82519)
- "Investigation of the Effects of Sliding on Wheel Tread Damage" by Mr. Brandon Talamini and Mr. Jeffrey Gordon, of the Structures and Dynamics Division, and Dr. A. Benjamin Perlman of Tufts University. (IMECE2005-82826)

- **Homeland Security Conference.** Dr. Sylvia Harris of the Telecommunications Division presented "Lessons Learned: An Assessment of the TSA Screener Training Quality Assurance (QA) Program" at the Fourth Annual Homeland Security Conference held in Albuquerque, New Mexico November 16–18, 2005. Sponsors of the conference include Sandia National Laboratories and Los Alamos National Laboratory. Dr. Harris' paper describes the results of recent support to the Transportation Security Administration (TSA).
- **Human Factors and Runway Safety.** Dr. Kim Cardosi of the Operator Performance and Safety Analysis Division contributed to a recently published book that compiles case studies on human factors applications in which there was a demonstrable success in terms of improvement in operational systems. Dr. Cardosi authored a chapter on runway safety based on human factors work performed at the Volpe Center for the Federal Aviation Administration. The book, *Human Factors Impacts in Air Traffic Management,* was edited by Barry Kirwan et al., and published by Ashgate Publishing of Aldershot, Hampshire, U.K., in 2005.
- **Cost-Benefit Analysis for Aviation Safety.** Dr. Larry Barr of the Advanced Safety Technology Division presented "Cost/Benefit Analysis of NASA Aviation Safety Program" at a workshop on Aviation Safety Improvement using Cost Benefit Analysis held at the European Aviation Safety Agency headquarters in Cologne, Germany, November 22, 2005. The Volpe Center has been conducting cost/benefit analyses for proposed safety technologies under the NASA Aviation Safety and Security Program.
- **Risk Management in Public Transportation.** As a member of the Technical Advisory Panel, Dr. Alan Rao of the Railroad Systems Division presented "An Overview of Risk Management in Public Transportation Systems in North America" at the 2005 Asia-Pacific Conference on Risk Management and Safety held in Hong Kong, China, December 1–2, 2005.
- **Advanced/Enhanced Traffic Management System.** Dr. Eugene Gilbo of the Automation Applications Division and Dr. Scott Smith of the Service and Operations Assessment Division published the report "Analysis of Uncertainty in Enhanced Traffic Management System (ETMS) Aggregate Demand Predictions." The report presents initial results of ongoing research conducted at the Volpe Center for the

Federal Aviation Administration's Advanced/Enhanced Traffic Management System program. (VNTSC-ATMS-05-05)

- **Wake Vortex Separation Standards.** Dr. James Hallock, Chief of the Aviation Safety Division, attended the 3rd Annual WakeNet2-Europe Workshop, "How can Wake Vortex Separation Standards be Revised," held on November 29–30, 2005 at the Eurocontrol Experimental Centre, Bretigny, France. He presented "How the Present Separation Standards Were Created."
- ***Journal of Fluids Engineering.*** Dr. Frank Wang of the Surveillance and Assessment Division co-authored "A Quantitative Comparison of the Delta Wing Vortices in the Near-Wake for Incompressible and Supersonic Free Streams," published in *Journal of Fluids Engineering*, v. 127, November 2005, pp. 1071-1084.

Volpe Center Names Directors to Lead the Offices of Aviation and Demonstration and Deployment Programs

As Director of Aviation Programs, Mr. Ned Keeler will head an office that supports the Federal Aviation Administration (FAA) and other aviation-related customers. The Office of Aviation Programs applies technical expertise in the areas of advanced technology research: communications, navigation and surveillance; air traffic management; and air traffic control. The office also specializes in aviation computer systems engineering, and performs environmental research in areas such as wake vortices, aircraft emissions, and noise pollution. Mr. Keeler brings 25 years of engineering and technical experience in government and industry organizations to the Volpe Center. He most recently served as Director of the National Aeronautics and Space Administration's (NASA) Independent Verification and Validation Facility. His extensive background in transportation includes serving as Commanding Officer of the U.S. Coast Guard's Research and Development Center.

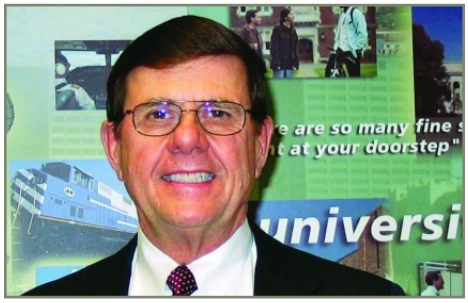
As Director of Demonstration and Deployment Programs, Ms. Kelly Leone will head an office that directly supports the U.S. Department of Transportation's (DOT) goals for increasing the safety, security, and global connectivity of the transportation system. Her office will explore and develop opportunities for improving transportation logistics, information safety, and security-related science and technology. The office also supports non-DOT customers such as the Departments of Defense and Homeland Security. Ms. Leone brings 20 years of transportation industry experience to the Volpe Center. She has worked on air traffic control modernization programs with the FAA and the German Civil Aviation Authority. She has particular expertise in the integration of explosives and weapons detection security technology into operational environments. Ms. Leone is currently completing a doctorate in transportation engineering at the New Jersey Institute of Technology.

Letter from the Director

Continued from page 1

tremendous experience and unique abilities of Ned Keeler and Kelly Leone will greatly enhance the Volpe Center's ability to advance state-of-the-art research and technology solutions for our nation's transportation system."

Both new directors are proven, capable leaders with strong transportation backgrounds; their skills and experience will be assets to the Volpe Center and to our clients. Ned Keeler's service to NASA and the Coast Guard will enhance the Center's continuing response to the needs of these organizations. Kelly Leone's background in the transportation industry, her experience working on air traffic control modernization for the Federal Aviation Administration, and her understanding of explosives technology and weapons detection will also be critical assets. Please see the article at left for more on our new directors.



Mr. Ned Keeler, Director of Aviation Programs at the Volpe Center.

Ms. Kelly Leone, Director of Demonstration and Deployment Programs at the Volpe Center.

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