Research and Innovative Technology Administration

the VOLPE center

National Transportation Systems Center

HIGHLIGHTS

Cambridge, Massachusetts May/June 2006

Curtis J. Tompkins

Letter from the Director

Supporting DOT and Other Agencies

As part of the Research and Innovative Technology Administration, the Volpe Center works with the modal administrations of DOT to advance the Department's priorities for innovation and research in transportation technologies and concepts. However, the Center is also committed to supporting the transportation requirements of other agencies. This interagency experience effectively leverages the Center's technical capabilities and allows us to gain expertise that will further support DOT's mission.

The Center's Maritime Domain Awareness (MDA) work described in the Focus article of this issue of *Highlights* exemplifies this cross-cutting approach. The Center is currently supporting the U.S. Navy in a major initiative to expand

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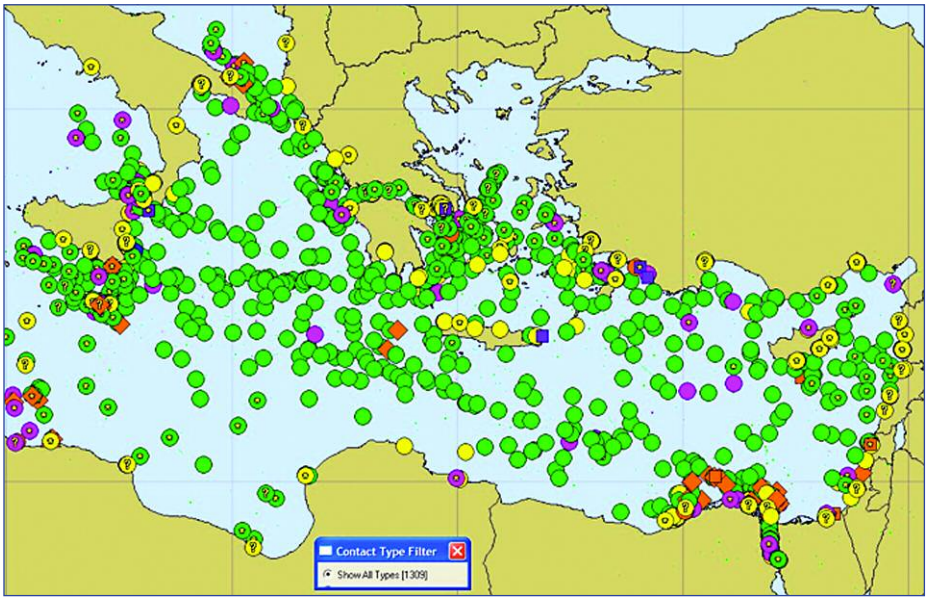
Inside

Focus



This screen depicts vessels in the Mediterranean Sea using the Maritime Safety and Security Information System developed by the Volpe Center for the U.S. Navy. The system allows the United States and its allies to track commercial vessels equipped with AIS transponders throughout the Mediterranean; the electronic chart shows a mark for every significant vessel, color-coded to depict status. The ship name, course and speed, classification, call sign, registration number, maritime identification number, and other information can be obtained by clicking on the ship's mark.

Maritime Domain Awareness

Increased Focus on Maritime Safety, Security, and Efficiency

To protect the nation's maritime transportation links and avert security threats, the United States must enhance its awareness of the maritime situation not only on its shores but also around the world. Our global competitiveness is tied to ensuring unimpeded trade and efficient marine transportation. The focus on Maritime Domain Awareness (MDA) responds to the nation's increased need for knowledge of potential security threats. The Department of Homeland Security currently defines MDA as "the effective understanding of anything associated with the global maritime environment that could impact the security, safety, economy, or environment of the United States."

The importance of global situational awareness is understood at all levels of government. President George W. Bush stressed that "the heart of the

Vessel Traffic Management Systems Developed by the Volpe Center

Saint Lawrence Seaway Vessel Tracking

The Great Lakes–Saint Lawrence Seaway system stretches over 2,000 miles between the United States and Canada, linking ports in the middle of North America and the Atlantic Ocean. In 2002, the Volpe Center designed and implemented a comprehensive vessel communications and tracking network to identify and track all commercial vessels on the Saint Lawrence Seaway. This became the first fully operational Automatic Identification System (AIS) network in North America. The system provides signal coverage from Montreal to eastern Lake Erie and enables automatic vessel position reporting from vessels equipped with AIS transponders to the Seaway Traffic Management System. A vessel equipped with AIS continuously transmits its location to the Seaway's traffic control center, as well as to other ships on the Seaway. The AIS network provides information such as wind speeds, water levels, visibility conditions, and lock schedules to transiting ships. In the traffic control center, the location, speed, and course of each vessel is continuously tracked and displayed on an electronic map of the Seaway. The system has improved safety, security, and efficiency throughout the Seaway.

Columbia River Project Employs TransView

The mountainous terrain and the twists and turns of the Columbia River make it difficult to navigate for deep-draft vessels and can make radar ineffective in situations where two large ships meet. The Volpe Center is designing, building, and will deploy a prototype vessel traffic information system for the Columbia River Pilots using AIS technology. The initial phase involves identifying requirements and developing and implementing a prototype on a trial area of the Columbia River. The system is being developed using TransView—the pilot navigation display software created by the Volpe Center. TransView was enhanced to provide river pilots with the capability to display the most recent channel soundings, or depth information, as soon as it is available from the U.S. Army Corps of Engineers. For more on TransView, see page 5.

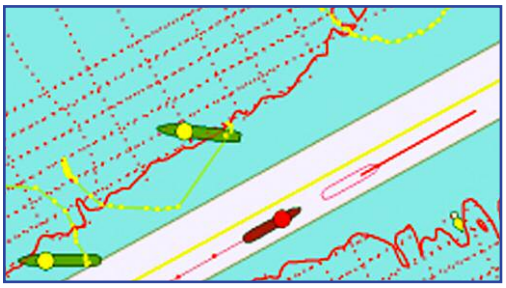
Buzzards Bay Oil Spill Prevention

The water and shores of Buzzards Bay, Massachusetts, have suffered several severe oil spills. In 1969, 175,000 gallons of oil were spilled when a barge ran aground, and more recently, in 2003, 15,000 gallons of fuel oil were spilled into the bay. The Volpe Center is designing and implementing a vessel tracking information system that will provide navigation aids and help protect the bay.

Central America Hurricane Recovery

Following Hurricane Mitch in 1998, which seriously damaged port capabilities in Honduras and Nicaragua, Volpe Center engineers, in cooperation with State Department agencies and the governments of host nations, installed advanced navigation systems at the three maritime ports that suffered the most damage. These reliable navigation systems allowed the resumption of maritime commerce and the delivery of relief goods. They also improved on the existing navigational capabilities of the afflicted ports and enabled them to operate for 24 hours a day in all weather conditions, with a very high degree of safety and efficiency.

Saint Lawrence Seaway Control Center—the first fully operational AIS network in North America.



TransView will provide the Columbia River Pilots with a rich set of visualization tools to aid in navigating around hazards. This display depicts in yellow the "swing" of anchored vessels due to tide change; the red contour lines represent the latest channel-sounding data.

Heavy oil barge traffic makes Buzzards Bay susceptible to oil spills.

The Volpe Center designed and built this transmitter station for the port of San Lorenzo in Honduras, modifying an ISO shipping container. A differential GPS radio beacon, in concert with Volpe-developed mobile navigation units, allows harbor pilots to accurately determine the position and progress of their own ships as they navigate narrow inland waterways.

Maritime Domain Awareness program is accurate information, intelligence, surveillance, and reconnaissance of all vessels, cargo, and people extending well beyond our traditional maritime boundaries." *A National Plan to Achieve Maritime Domain Awareness* was published in 2005, in response to National Security Directive 41 and Homeland Security Presidential Directive 13, which directed that the Department of Defense and the Department of Homeland Security together develop a national plan for maritime security. Volpe Center experts in transportation and navigation have provided the technological foundation for this effort.

Navigation Systems Evolve

Since the 1990s, the Volpe Center has played a critical role in developing and applying advanced technologies that have made it possible for mariners to detect the presence and determine the position of other vessels quickly and accurately, regardless of weather or location. When Center staff first started to address the navigation problems of seaways, they were breaking new ground: developing coordinated systems of mobile units that communicated with a control center via a shore-based communications network. These mobile units, which were carried on board transiting vessels, consisted of a Global Positioning Systems (GPS)-based transponder that relayed the position of the vessel to a shoreside entity or other vessels, and a laptop computer that the pilot used for navigation. Vessel positions were integrated with other information and presented in a real-time electronic map display.

Initially, this technology was used to help large vessels traverse narrow waterways such as the Panama Canal. This capability then evolved into a more comprehensive vessel communications and tracking network, which was first developed for the Saint Lawrence Seaway Development Corporation to identify and track all commercial vessels on the Saint Lawrence Seaway. (See box on page 2 for more details on vessel tracking and navigation projects.)

The Panama Canal: Making Navigation History

The system developed by the Center's technical staff for use in the Panama Canal represented a significant milestone in navigation history. The 51-mile Panama Canal links the Atlantic and Pacific Oceans through the Isthmus of Panama and uses a sequence of locks to raise and lower vessels. Canal navigation has always been complex due to the terrain, the locks, the tropical rain, and the heavy traffic. Compounding this complexity, Panama had essentially employed the same vessel management system that was initiated when the Canal became operational in 1914. In 1995, the Panama Canal authorities requested the Volpe Center's support in developing a modern vessel piloting and tracking system for use in their waterway.

The Volpe Center designed and implemented an advanced communications, traffic management, and navigation system for the Canal that enabled pilots to guide massive ships through narrow channels and into the six locks of the Canal in all weather conditions. The system provided canal pilots with advanced navigation tools and enabled traffic controllers to track all transiting vessels, as well as all canal watercraft—dredges, tugs, and launches—giving all users superior canal waterway traffic situational awareness. The result: a tremendous increase in the safety and efficiency of vessel transits and an accompanying increase in Panama Canal revenues.

Sophisticated navigation aids developed in the 1990s by the Volpe Center helped transiting vessels deal with fog, narrow locks, and tight corners.

Automatic Identification System

The introduction of the Automatic Identification System (AIS) provided the potential for expanding the kind of technology that Volpe Center staff had developed for individual locations to a national and even global scale. AIS is a shipboard broadcast transponder system in which ships continually transmit their ID, position, course, speed, and other data to all other nearby ships and shoreside authorities on a common VHF radio channel. The International Maritime Organization mandates that commercial ships over 300 gross tons carry transponders and AIS equipment under the International Conventions of Safety of Life at Sea (SOLAS), which specifies minimum standards for the construction, equipment, and operation of ships, compatible with their safety. The AIS requirement went into effect in U.S. waters on December 31, 2004.

The Volpe Center's Role Changes

As described in the MDA National Plan, a key component of MDA is to provide "an active, layered maritime defense in depth… by improving our ability to collect, fuse, analyze, display, and disseminate actionable information and intelligence to operational commanders." As a result of the universal availability of AIS as standard equipment on most commercial vessels, the Volpe Center's role has changed and become more focused

on providing this kind of networked capability to gather and disseminate information. A key example, the Maritime Safety and Security Information System (MSSIS) developed by the Center for the U.S. Navy, is described in the following section.

Volpe Center capability in this area is rooted in its development and implementation of TransView (TV32)—a Geographic Information System (GIS) software developed initially in the 1990s to provide real-time display of vessel tracking and navigation information for pilots in the Panama Canal. TV32 is adaptable across a number of projects and can be customized readily and used for prototyping in new situations. TV32 can be configured to satisfy all display requirements, including enhanced navigation safety, waterway efficiency, traffic situation awareness, force protection, and data analysis.

Recent Volpe Center Achievements

Recent high-profile navigation systems developed by the Volpe Center's Marine Systems Division include:

- An international network comprising MDA tools
- A nationwide system for identifying vessel positions and generating ship movement information
- A security system for identifying vessels in ports

Worldwide Maritime Domain Awareness: Maritime Safety and Security Information System

The Volpe Center's navigation work has always had an international component, but this arena has expanded recently to include work for the U.S. Navy in Europe, the Mediterranean, and Africa. By developing the MSSIS network, the Volpe Center is supporting the U.S. Navy's requirement to extend its MDA capabilities to include information about commercial vessels equipped with AIS transponders. MSSIS collects and disseminates real-time data derived from AIS about vessel movements.

Through this work, the Center is directly supporting the Commander, U.S. Navy Europe/Commander Sixth Fleet (CNE-C6F). CNE-C6F's goals are two-fold: to expand its MDA capabilities in its Area of Responsibility (AOR) and to develop an unclassified network that can provide real-time data that is essential to maritime security and safety.

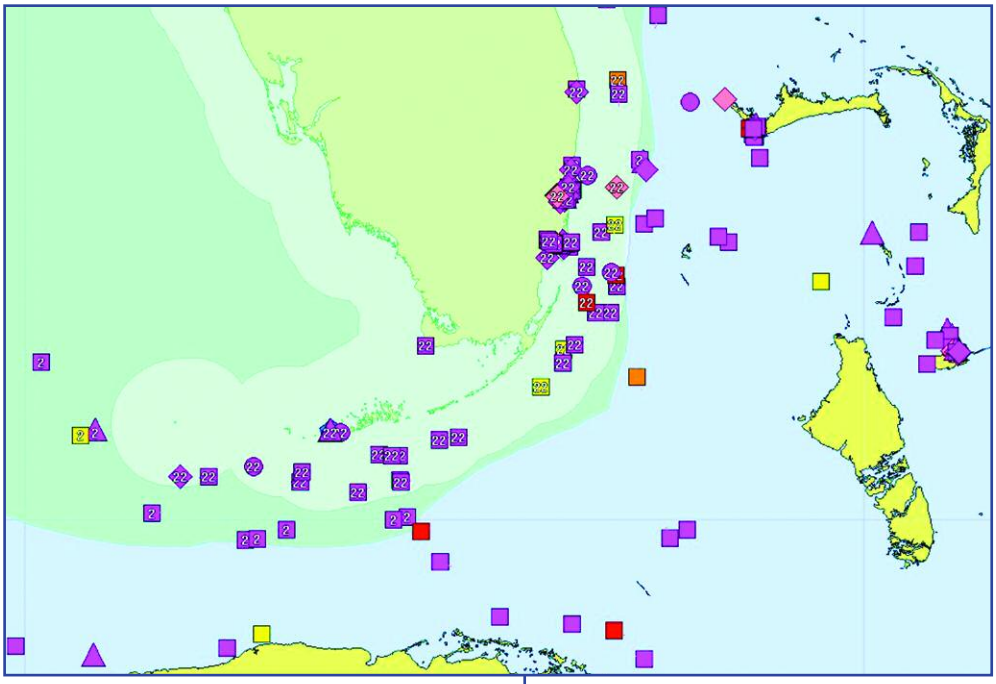
MSSIS has an important diplomatic role: because it is unclassified and can be shared with U.S. allies, it may foster increased cooperation. NATO Joint Forces Command has been assisting CNE-C6F in furthering the growth of this system. Volpe Center staff work directly with these foreign entities, including several NATO countries, providing them with the software to display vessel movement using AIS. MSSIS is also being used by the United

Volpe Center's TransView Software

TransView, or TV32, is GIS software developed and implemented by the Volpe Center to provide real-time display of vessel tracking and navigation information. TV32 is:

- Adaptable across a number of projects; can be customized readily and used for prototyping in new situations
- Configurable to satisfy all display requirements, including enhanced navigation safety, waterway efficiency, traffic situation awareness, force protection, and data analysis

Kingdom in the Persian Gulf. The global benefits of such sharing include greater involvement by countries in this region in the surveillance of their own maritime waters and in addressing security concerns.



This display image depicts the Nationwide Automatic Identification System identifying vessels off the coast of southern Florida.

Nationwide Automatic Identification System: Monitoring Vessels Across the Nation

The success of the many navigational systems designed by the Volpe Center for discrete geographic areas has led to our supporting the U.S. Coast Guard in developing a Nationwide Automatic Identification System (NAIS). In compliance with the Maritime Transportation Security Act of 2002, and to meet maritime domain awareness objectives, the U.S. Coast Guard is developing this nationwide vessel-monitoring network based on the AIS transponder technology. NAIS will provide information that identifies the multitude of vessels that operate along the more than 95,000 miles of shoreline, and in the 25,000 miles of navigable waterways and 3.4 million square miles of open water that compose the U.S. economic exclusion zone. NAIS will gather real-time vessel position reports and ship movement data and disseminate the information to the U.S. Coast Guard and other authorized authorities. The information provided will be a key component in improving the safety and security of all of the nation's maritime interests—from the safety of vessels and ports through collision avoidance to the safety of the nation through detection, traffic management, and classification of vessels when they are still thousands of miles offshore.

The Volpe Center is providing technical assistance in the form of systems engineering expertise for the development of a prototype NAIS network. Other Volpe tasks include AIS network system design; site design; hardware procurement; system deployment, installation, and integration; development of testing and evaluation plans; and overall program management.

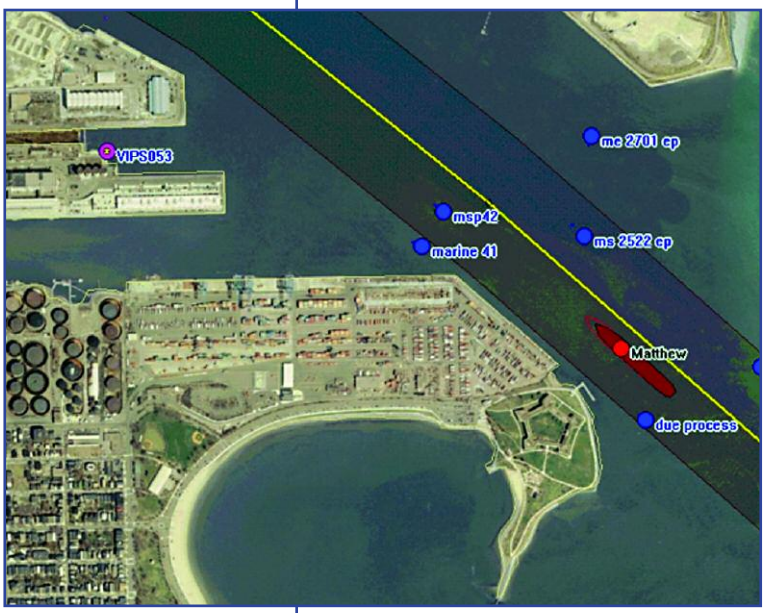
Vessel Identification and Positioning System: Protecting High-Value Vessels in Port

The attack on the USS *Cole* in the Yemeni port of Aden in October 2000 heightened security concerns for vessels in foreign ports. In that instance, a small harbor craft approached and struck the Navy destroyer; the resulting

explosion killed 17 sailors and injured 39 others. Consequently, the U.S. Navy realized the need to provide its ships with better protection in ports throughout the world. This required a way to determine whether vessels approaching Navy ships were authorized to do so. In support of the Technology Support Working Group (TSWG) and the U.S. Navy, the Volpe Center adapted its navigation technology to provide a new concept for protecting ships against terrorist attacks.

VIPS employs GPS technology in portable, highly secure transponders that are installed on authorized vessels. Each has a VHF-encrypted data link, and encryption keys are easily changed via the transponder's smart card reader. The Center designed these portable units to operate from a variety of AC and DC power sources; each also includes an internal lithium ion battery pack. Vessels equipped with VIPS are tracked on displays such as that shown below.

The resulting Vessel Identification and Positioning System (VIPS) developed by the Volpe Center has been implemented in several locations to enhance safety, security, and environmental compliance. Port security is improved by providing real-time, situation-awareness capabilities. VIPS employs GPS technology in specially designed transponders that are installed on authorized vessels. VIPS-equipped vessels can then be tracked on a geographical display, providing a secure way to identify vessels authorized to approach a government or other high-value marine asset. VIPS employs sophisticated information security whereby transponder communications are encrypted using the Advanced Encryption Standard adopted by the U.S. government. Also, each VIPS unit installed on a harbor vessel employs tamper-and-theft detection sensors. Prospective terrorists can neither develop a forged unit by solving message encryptions nor steal and use a VIPS transponder with current encryption for use at a future date. VIPS also uses the TransView GIS software (see page 5), which allows real-time tracking of vessels as well as automated alarms when vessels enter or leave specified geographic regions. Land-based and ship-borne radar data and dynamic protection zone capability have also been integrated, thus improving operators' situational awareness of their surroundings.



VIPS was used to protect Boston Harbor during the 2004 Democratic National Convention. The blue dots indicate law enforcement vessels equipped with VIPS transponders.

In 2002, Naval Station Norfolk was the first U.S. facility to incorporate VIPS in harbor-protection procedures. In 2003, VIPS was installed on law enforcement patrol boats in Boston Harbor to provide harbor security during transits of vessels such as tankers carrying LNG (liquified natural gas) and other high-interest vessels such as Navy ships and cruise ships. The Boston Harbor Pilots are avid proponents and users of VIPS. In 2004, the Volpe Center expanded the system already used by the U.S. Coast Guard in Boston Harbor to provide local law enforcement agencies with an

A vessel carrying liquified natural gas enters Boston Harbor escorted by law enforcement patrol boats equipped with VIPS.

enhanced harbor surveillance system during the Democratic National Convention. Additional capabilities provided included the integration of VIPS contacts with radar system targets on single displays at control centers and on ship displays.

Concern for international port security continues. VIPS and AIS have been installed in Rota, Spain, and Souda Bay, Crete, to support the U.S. Naval Station's port security needs. VIPS/AIS may also have potential benefit in the Persian Gulf and in Africa's coastal waters.

The Future of Maritime Domain Awareness

The improved global connectivity and security provided by MDA will benefit all stakeholders. The Volpe Center's role is to provide the raw data; its use depends on the individual stakeholders and the current needs. However, as former Secretary of Transportation Norman Y. Mineta said in a speech to the U.S. Chamber of Commerce, "our growing international linkages compel us to face a… transportation truth: Americans must be concerned with the safety of not just our own, but of the world's transportation systems."

Volpe Center MDA Team

Kam Chin
McCharles Craven
Bryan Long
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David Phinney
Henry Wychorski

Helping States Improve Motor Carrier Safety Data Reporting (FMCSA)

The Federal Motor Carrier Safety Administration (FMCSA) is dedicated to reducing the number and severity of crashes involving large trucks and buses on U.S. highways. FMCSA's data-driven safety programs comprise a key element of its strategic approach to improving motor carrier safety. Accordingly, the agency has several initiatives for continually evaluating, monitoring, and improving the quality of safety data that supports these programs. One such initiative is the State Data Quality Review Program, established in 2005 by the FMCSA and supported by the Volpe Center.

FMCSA relies on states to provide it with standard, basic information about commercial motor vehicle crashes and roadside inspections. The objective of the State Data Quality Review Program is to document an individual state's processes for collecting and reporting crash and inspection data and to identify areas for improvement. FMCSA prioritizes states for review based on an assessment of their data quality and the contribution of their state-reported data to the entire nation's data quality. States seeking to improve the quality of their safety data participate in an onsite review conducted by a federal team. During the onsite review, state and federal staff work together to define the state's processes, identify bottlenecks and practices that compromise data quality, and suggest potential recommendations for improvement. After the onsite review, communication between the state and federal teams continues as a report and recommendations for improvement are developed. State officials can apply to FMCSA for technical assistance in implementing any recommendations. To date, the Volpe Center has conducted onsite reviews with transportation officials in three states: New Hampshire, North Carolina, and New Jersey.

Most recently, from March 21 through 23, 2006, Volpe Center staff met with managers and support staff of the FMCSA's New Jersey Division office, the New Jersey State Highway Patrol (SHP), and the New Jersey Department of Transportation (NJDOT), interviewing the SHP and NJDOT personnel involved with collecting and reporting safety data to FMCSA. The Volpe Center team then developed its report describing New Jersey's safety data reporting processes and identifying recommendations for process improvements. One person from the Volpe Center will continue working with the state to assist in implementing any recommendations chosen. Led by Ms. Elizabeth Deysher of the Motor Carrier Safety

The Volpe Center supports FMCSA in carrying out its safety mandate by providing safety analysis expertise and innovative information resources.

Volpe Center Safety Data Team

Elizabeth Deysher, Team Leader
Candace Brown
Jeremy Crowell
Dana Larkin
Courtney Stevenson
Kevin Berry
Shaun Dagle
Alla Ilchenko
Walt Zak

Division, the Volpe Center team includes Ms. Candace Brown, Mr. Jeremy Crowell, Ms. Dana Larkin, and Ms. Courtney Stevenson, all of the Division, and Mr. Kevin Berry, Mr. Shaun Dagle, Ms. Alla Ilchenko, and Mr. Walt Zak of the TRACX contract led by CASE, LLC (a Volpe Center onsite contractor).

Supporting Global Aviation Efforts for Better Air Traffic Surveillance (FAA)

The Federal Aviation Administration's (FAA) Flight Plan includes international leadership as a key goal and promotes aviation safety, security, environmental compliance, and connectivity not only within U.S. borders, but also across the globe. In this capacity, the United States leads the world in developing and implementing new technologies to create a safer and more efficient global airspace system and cooperates with bilateral, multilateral, regional, and global aviation partners to achieve these goals.

Internationally, FAA works with the International Civil Aviation Organization (ICAO), which represents most of the world's civil aviation authorities, as well as with Eurocontrol and other regional and national authorities, toward setting aviation standards and policies. The Volpe Center contributes to this effort not only by developing and testing technologies that have global aviation applications, but also by supporting FAA's efforts to disseminate information and coordinate plans regarding these technologies among international aviation partners.

FAA has begun a program to implement a new surveillance technology known as Automatic Dependent Surveillance–Broadcast (ADS-B) for use by air traffic controllers in separating aircraft as well as by pilots in maintaining awareness of the traffic situation around them. FAA is augmenting ADS-B aircraft messages with a new ground broadcast service containing information about non-ADS-B aircraft as well as weather, flight restricted areas, and other data. Initial implementation of ADS-B and ground broadcast services will be in locations that currently lack radar coverage. Subsequent nationwide deployment will allow removal of some radar installations, enable new flight procedures not available today, and promote safety by providing pilots with greater knowledge of their operating environment.

Implementation of ADS-B/broadcast services requires that standards for messages from aircraft and ground equipment be established for use worldwide. To this end, Volpe Center staff support FAA by attending international meetings to explain the technology; to coordinate the development of common standards; and to address technical and operational issues, implementation dates, regulatory actions, and the economic impact of a transition from radar to ADS-B surveillance. In recent months, Mr. Rick Castaldo of the Center's Advanced Communication, Navigation, and Surveillance (CNS) Technologies Division has traveled to Brussels, Belgium, to meet with Eurocontrol officials; New Delhi, India, to meet

ADS-B is a new technology for airborne and surface surveillance developed for use by air traffic controllers in separating aircraft as well as by pilots in maintaining awareness of the traffic situation around them. The Volpe Center supports FAA's efforts through technical development as well as coordination with aviation partners around the world.

Volpe Center Air Traffic Surveillance Team

Michael Geyer, Technology Development and Testing Lead
Rick Castaldo, International Coordination Lead

with representatives of the Indian Aviation Authority; Dar es Salaam, Tanzania, to explain the system to representatives from several African national Civil Aviation authorities; and Glasgow, United Kingdom, to help accelerate the application of ADS-B in European airspace to increase airspace capacity and safety. In April, Mr. Castaldo participated in a Eurocontrol workshop titled "Co-operative Air Traffic Services through Surveillance and Communication Applications Deployed in European Civil Aviation Conference" in Toulouse, France, to foster understanding of the U.S. ADS-B program.

Train-to-Train Test of New Crash Energy Management System (FRA)

The Volpe Center is conducting research for the Federal Railroad Administration (FRA) into new technologies that could vastly improve the crashworthiness of passenger rail cars. The eighth and most complex in a series of full-scale tests was conducted successfully on March 23, 2006, at DOT's rail-testing facility in Pueblo, Colorado. The test was designed to determine the viability of innovative, energy-absorbing designs of commuter rail cars, as well as passenger seats and tables, in better protecting rail passengers and crew members.

A five-car, cab-forward passenger train equipped with a crash-energy management (CEM) system was crashed head-on into an equally weighted

The Volpe Center's ongoing research on rail equipment crashworthiness for FRA integrates computer modeling and full-scale test crashes. **Below***: 2002 crash test results using conventional equipment.* **Bottom:** *Simulation of March 23, 2006 test using crash energy management (CEM) system.*

standing locomotive with two freight cars, at a speed of 32 miles per hour. The CEM design uses zones of controlled crush; collision energy is absorbed by a series of components and distributed to unoccupied areas throughout the length of a train, rather than crushing large volumes of the first car, as is characteristic of current equipment. The CEM-equipped train survived the test relatively unscathed and both trains remained upright and on the tracks, in contrast to earlier tests on typical rail equipment. The seats and tables appeared to have performed equally well.

This crash test was the first to incorporate a CEM system and other passenger safety technologies, including the following.

- Crush zones protect the passenger and operator space and distribute the force of impact to unoccupied areas of the train.
- Pushback couplers and anti-climbers absorb the force of impact, hold the train cars together, and keep trains upright and in line.
- Strengthened end frames, advanced bumpers, and other structural improvements help absorb energy and lessen the impact on passengers.
- Improved seats are strategically padded and designed to contain and cushion passengers during a crash.
- Newly designed worktables with crushable edges reduce the risk of abdominal injury.

The Volpe Center is closely analyzing the test data, gathered with hundreds of sensors, dozens of cameras, and ten instrumented dummies. However, preliminary results hold promise for the next generation of rail cars and their occupants. Current equipment can protect occupants in crashes of up to 15 mph; equipment with all the features tested on March 23 can protect occupants up to a speed of 36 mph. The Rail Equipment Crashworthiness Research Team is comprised of Mr. Michael Carolan, Ms. Karina Jacobsen, Mr. Eloy Martinez, Mr. Daniel Parent, Dr. Benjamin Perlman, Ms. Michelle Priante, Ms. Kristine Severson, and team leader Mr. David Tyrell, all of the Center's Structures and Dynamics Division.

The March 23 test was a milestone in the testing program developed by the Volpe Center in support of the FRA Office of Research and Development's Equipment and Operating Practices Research Division. Since 1989, the Center has been performing in-depth studies to determine effective strategies for improved structural crashworthiness and occupant protection. The first series of full-scale tests defined the crashworthiness of conventional-design equipment in three impact conditions. Corresponding tests of modified passenger rail cars allowed comparison of the performance of both types of equipment. The Center's ongoing

Included among the many new elements of the improved worktable design are a melamine top and crushable, energy-absorbing aluminum honeycomb interior. During the March 23 test the table was deformed by the impact of the dummy; this design could mitigate abdominal injury to passengers.

Volpe Center Rail Equipment Crashworthiness Team

David Tyrell, Team Leader
Michael Carolan
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Michelle Priante
Kristine Severson

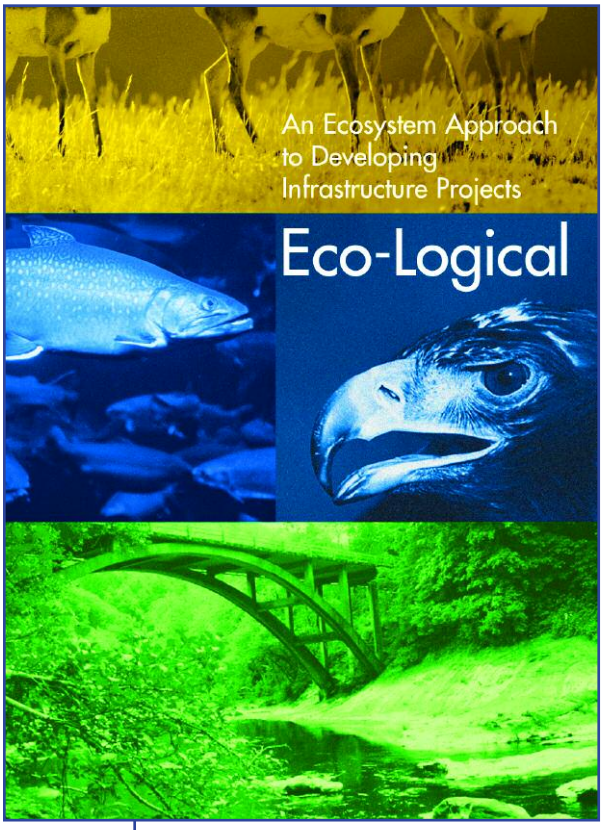
research, which integrates computer modeling and full-scale test crashes, supports the development of federal regulations and standards for new rail car designs.

The Volpe Center's role includes defining appropriate scenarios to study collisions, developing computer models to simulate the structural and dynamic results of the collisions, designing and supervising the full-scale tests, processing the test data, and comparing the test measurements with the analysis results. The computer models are then used to evaluate a wider range of collision conditions than can be tested.

Environmental Stewardship

Interagency Group Releases Ecological Guide to Infrastructure Development (FHWA)

Over the last several decades, an understanding of how infrastructure–the basic facilities needed for the functioning of a community or society–can negatively impact habitat and ecosystems has grown. Awareness of how to better avoid, minimize, and mitigate these impacts has also matured. However, translating this awareness into action requires a significant change from the traditional project-by-project approach to infrastructure development. To help agencies make this transition to cost-effective infrastructure development that contributes to ecosystem conservation, an interagency team recently released Eco-Logical: An Ecosystem Approach to Developing Infrastructure Projects.



The ecosystem approach defined in Eco-Logical *can achieve a range of benefits, including safer, improved infrastructure; improved watershed and ecosystem health; increased connectivity and conservation; efficient project development; and increased transparency.*

A team comprising representatives of the Federal Highway Administration (FHWA), Bureau of Land Management, Environmental Protection Agency, U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, U.S. Department of Agriculture Forest Service, National Park Service, NOAA Fisheries, the Volpe Center, and several state departments of transportation worked together to develop this unprecedented guide to cooperative conservation. In support of FHWA, the Volpe Center's Planning and Policy Analysis Division played a key role in facilitating the development of *Eco-Logical.*

Embodying the intent and principles of the National Environmental Policy Act (NEPA) and Executive Order 13352 on Facilitation of Cooperative Conservation, *Eco-Logical* offers a non-prescriptive approach to making infrastructure more sensitive to wildlife and ecosystems through

integrated planning, new partnerships, and cooperative conservation. Central to *Eco-Logical* is the "ecosystem approach," a process for the comprehensive management of land, water, and biotic and abiotic resources that equitably promotes conservation and sustainable use. This approach shifts the federal government's traditional focus on individual agency jurisdiction to the integrated actions of multiple agencies. It finds ways to increase voluntary contributions from all stakeholders, including the public, to a collaboratively developed vision of desired future conditions that incorporates ecological, economic, and social factors. It is applied within a geographic framework defined primarily by ecological, rather than geopolitical, boundaries. *Eco-Logical* is posted on the Internet at *www.environment.fhwa.dot.gov/ecological/eco_index.asp*.

Published & Presented

- **Final Report on Automobile Crash Avoidance Technologies.** For the National Highway Traffic Safety Administration, Dr. Wassim Najm, Mr. Jonathan Koopmann, and Mr. John Hitz, all of the Advanced Safety Technology Division, and Dr. Mary Stearns and Dr. Heidi Howarth of the Human Factors Division produced a final report on the independent evaluation of an automotive collision avoidance system built by General Motors and Delphi. "Evaluation of an Automotive Rear-End Collision Avoidance System" (DOT VNTSC-NHTSA-06-01, DOT HS 810 569) provides the results of a 2000–2005 effort by the Volpe Center. It can be downloaded from *www-nrd.nhtsa.dot.gov/departments/nrd-12/pubs_rev.html*.

- **Intelligent Transportation Systems.** Mr. Scott Smith of the Service and Operations Planning Division co-authored "On-Line Deployment of Dynamic Traffic Assignment: Architecture and Run Time Management," published in the *Institution of Electrical Engineers (IEE) Proceedings in Intelligent Transport Systems,* v. 153, n. 1, March 2006, pp. 76-84. The other authors, who are affiliated with the Massachusetts Institute of Technology, are Yang Wen (primary author), Ramachandran Balakrishna, and Moshe Ben-Akiva.

- **Aviation Noise and Air Quality Symposium**. Staff from Volpe's Environmental Measurement and Modeling Division presented at the Aviation Noise and Air Quality Symposium in Berkeley, California, March 6, 2006. See the presentations at *www.techtransfer.berkeley.edu/aviation06downloads*.

  - "Modeling Supplemental Metrics with INM v.6.2," Mr. Eric Boeker. For the Federal Aviation Administration (FAA), the Volpe Center

Volpe Center Eco-Logical *Team*

Cassandra Allwell, Team Leader
Jeffrey Bryan
Carson Poe

developed and supports INM, the Integrated Noise Model, which is used for evaluation of aircraft noise impacts near airports in 30 countries.

- "FAA/AEE's Aviation Environmental Design Tool (AEDT)," Mr. Gregg Fleming. The Volpe Center is leading the effort to develop AEDT, a multifaceted and comprehensive new tool that will enable integrated noise and emission modeling on a range of scales, from local to global.

- **Aircraft Wake Vortex Classification**. Dr. James Hallock, Senior Technical Expert for Air and Space Transportation Safety, continues his leading research on aircraft wake vortices. Dr. Hallock presented a paper titled "757 Wake Classification Analysis" at the WakeNet USA meeting in Dallas-Fort Worth, Texas, March 28–31, 2006. The paper was coauthored with Ms. Melanie Soares of the Advanced Communications, Navigation, and Surveillance (CNS) Division. The 300 model of the B757 is treated as a heavy aircraft based on its maximum gross certificated takeoff weight. However, the analysis shows that the 300 model wake vortices are no different than the 200 model vortices; therefore, the B757-300 need not be assigned an additional 1-nautical-mile separation during approach and landing operations.

- **Automobile Crash Avoidance Technologies Evaluated.** At the 2006 World Congress of Automotive Engineers in Detroit, Michigan, April 3–6 2006, Volpe Center and National Highway Safety Administration sponsor staff members presented the results of research on crash avoidance technologies.

  - "Performance of a Rear-End Crash Avoidance System in a Field Operational Test, " Dr. Wassim Najm and Mr. Jonathan Koopmann of the Advanced Safety Technology Division. This paper addresses the efficacy of forward-looking sensors on automobiles to track targets, the efficacy of the alert logic in warning the driver to driving conflicts that may lead to rear-end crashes, and the effectiveness of the driver-vehicle interface to display safety-critical information.

  - "Exploratory Analysis of Pre-Crash Sensing Countermeasures," Mr. Ron Pack of the National Highway Traffic Safety Administration and Dr. Wassim Najm and Mr. Jonathan Koopmann of the Advanced Safety Technology Division. This paper provides results from a technology review of pre-crash sensing systems, identification of applicable crashworthiness scenarios, and estimation of safety benefits for brake-assist and driver-seat-position adjustment measures.

- **2006 ASME/IEEE Joint Rail Conference**. Two papers by Volpe Center staff were published in the proceedings of the 2006 Joint Rail Conference in Atlanta, Georgia, April 4–6, 2006, co-sponsored by the

American Society of Mechanical Engineers (ASME) and the Institute of Electrical and Electronics Engineers (IEEE) Vehicular Technology Society. The documents are available through *www.volpe.dot.gov/sdd/pubs-crash.html.*

- "Overview of a Crash Energy Management Specification for Passenger Rail Equipment," Mr. David Tyrell, Mr. Eloy Martinez, Ms. Karina Jacobsen, Mr. Daniel Parent, Ms. Kristine Severson, Ms. Michelle Priante, and Dr. Benjamin Perlman of the Structures and Dynamics Division. JRC2006-94044, April 2006.
- "Effectiveness of Alternative Rail Passenger Equipment Crashworthiness Strategies," Ms. Karina Jacobsen, Ms. Kristine Severson, and Dr. Benjamin Perlman of the Structures and Dynamics Division. JRC2006-94043, April 2006.

- **Public Meeting on the Benefits of Advanced Crash Avoidance Systems.** The U.S. DOT hosted a public meeting in Ypsilanti, Michigan, April 20–21, 2006, to present results from two recently completed light vehicle field operational tests (FOTs) of prototype collision warning systems, the Automotive Collision Avoidance System (ACAS) and the Roadway Departure Collision Warning (RDCW). (See *www.itsa.org/usdot_public_meeting.html.*) The ACAS FOT focused on the development and evaluation of adaptive cruise control and forward collision warning systems, while the RDCW FOT considered lane departure and curve speed warning systems to prevent roadway departure collisions. Volpe Center staff from the Advanced Safety Technology Division played a key role in evaluating these technologies. Dr. Bruce Wilson presented a paper titled "Preliminary Results of the Road Departure Crash Warning System (RDCW) Independent Evaluation." Dr. Wassim Najm presented the following three papers: "Computing Safety Benefits and Sources of Data," "Independent Evaluation of Automotive Collision Avoidance System (ACAS)," and "Integrated Vehicle-Based Safety System (IVBSS) Scenarios/Volpe National Transportation Systems Center (Volpe Center) Activities."
- **Position Location and Navigation Symposium.** Ms. Karen Van Dyke of the Advanced Communication, Navigation, and Surveillance (CNS) Technologies Division presented "Development of a GNSS Performance Monitoring System (GPMS)" at a symposium jointly sponsored by the Institute of Electrical and Electronics Engineers and the Institute of Navigation in San Diego, California, April 25–27, 2006.

Letter from the Director

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MDA globally. This work has its roots in our long-term involvement in marine navigation. For example, navigation history was made in the 1990s when a commercial vessel was tracked for the first time in the Saint Lawrence Seaway with a GPS-based system developed by the Center. As described in this issue, this technology was further refined and implemented as an operational system for the Panama Canal and later for ports in Honduras and Nicaragua. With the introduction of the Automatic Identification System (AIS) and the requirement that commercial vessels over a certain size transmit location and other navigational information, our role has expanded, and we now support several agencies in gathering and distributing this information and thus enhancing Maritime Domain Awareness.

In addition to the U.S. Navy, organizations that have turned to the Volpe Center for support in this area have included the Technology Support Working Group, the Department of Homeland Security (U.S. Coast Guard), the State Department, Columbia River Pilots Association, the Boston Harbor Pilots, the State of Massachusetts, the City of Boston, the Saint Lawrence Seaway Development Corporation, the Panama Canal Commission, and the Army Corps of Engineers, as well as several NATO countries.

Not only do these diverse organizations benefit from the Volpe Center's expertise, but with each project, we enhance our ability to support DOT in achieving its strategic goals.

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