



Volpe
National
Transportation
Systems
Center

Volpe Center Highlights

Cambridge, Massachusetts

June/July 2001

Director's

Notes



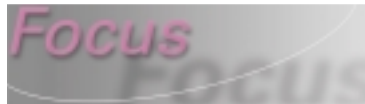
Dr. Richard R. John

Fostering Innovation through National Transportation Symposia

The nation faces many challenges as we work to improve the transportation system. Among these challenges are the successful implementation of public-private partnerships, effective transportation education and training, and the application of innovative technologies. The Volpe Center has been addressing each of these challenges, most recently through a series of three national symposia that draw on the experience of national experts from government, industry, and academia. The three national symposia exemplify our role as a nexus of innovation in transportation.

The Center hosted the National Symposium on Implementing Successful Public-Private Partnerships in Transportation on May 15 and 16, 2001. Public-private partnerships are an approach to problem solving whereby resources or capacities of different organizations are pooled together for a common purpose. Because this approach is an evolving concept in transportation, this meeting sought to define the "state of the art" of such arrangements, with references to successful efforts and future opportunities. Participants agreed that, while there are many different types of such partnerships, most face similar challenges: identifying appropriate projects,

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Improving the Safety and Efficiency of Air Travel (FAA)

Summer is the season for vacations, but for too many travelers, it is also the season for delays. Crowded flights, busy airports, and severe thunderstorms all contribute to challenging conditions for the nation's air traffic controllers, pilots, and airlines. The Volpe Center is working alongside the Federal Aviation Administration (FAA) and private industry partners to improve the safety and efficiency of air travel through the Enhanced Traffic Management System (ETMS) and other advanced air traffic control tools.



The Volpe Center developed and supports ETMS, the real-time operational computer system that the FAA uses to predict, detect, and handle airspace congestion problems. Air traffic managers interact with the system through the Traffic Situation Display (TSD), a graphical display of air traffic, weather, alerts, and statistical information. The TSD screen above shows more than 5000 flights being tracked over the United States. Managers can click on any flight icon to display flight information, as shown in the lower left corner.

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Improved Version of ETMS Released

Many air traffic delays are attributable to severe weather (such as thunderstorms) en route or low visibility at the destination airport. On May 17, 2001, the Automation Applications Division, under the direction of Mr. Dick Bair, introduced an improved version of ETMS, the real-time operations system used by the FAA and airlines to manage traffic through the nation's airspace. This release contains major improvements that will increase efficiency and facilitate Collaborative Decision Making (CDM), the FAA's high-priority initiative to improve operational service through sharing of information between the airlines and the FAA's Air Traffic organization. CDM is an innovative process that enables decisions regarding landing priorities and rerouting to be made by airlines or by the airlines and FAA together.

Flights destined for an airport where visibility is low are often held before they leave the ground, in order to avoid circling the airport when they arrive. The improved system contains information on changing airport weather conditions, known as Runway Visual Range (RVR) data, at 45 high-activity airports. Formerly, visibility data was only available directly from the traffic control tower at each airport. Now that this RVR data is available in real time nationwide, airlines and the FAA will be notified immediately that conditions at the destination airport are improving, thus enabling them to make decisions accordingly. Positive results of this common situational awareness were noted immediately. The day the new system was installed, Northwest Airlines noted to the Volpe Center how the immediate availability of RVR data allowed the airline and FAA to quickly agree on ending a ground delay and resuming regular service.

The new version of ETMS also includes a Simplified Substitution Process for airlines to request priority handling of certain flights. In earlier versions of ETMS, scheduling determinations were based primarily on the scheduled arrival time of each flight. Now, if a certain flight has many passengers who need to make connections or a crew near the end of its shift, the airline has a much simpler method to easily override the time-of-arrival list and give that flight a higher priority than others operated by the same carrier. This feature has special significance at hub airports, where it will help airlines to reduce the number of missed connections attributable to weather delays.

"The up-to-the-second information helped Northwest Airlines to deal effectively with our part of the solution to the dreaded fog event."

Mr. Bill Leber, Chief Dispatcher, Northwest Airlines.

In order to improve safety and efficiency en route, the new version of ETMS also allows traffic managers to identify Flow Constrained Areas, where severe weather such as thunderstorms may require rerouting of through traffic. Early identification of these Flow Constrained Areas will allow air traffic controllers to plan ahead and avoid bottlenecks where multiple flights are attempting to avoid the same storm.

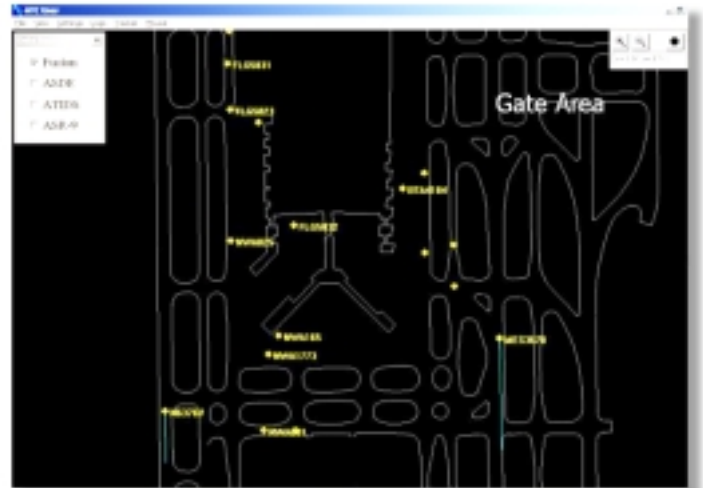
ETMS Road Show Training Brings Air Traffic Controllers Up to Speed

While ETMS is developed and operated here at the Volpe Center, it is used by air traffic managers throughout the country. These managers interact with the system through the Traffic Situation Display (TSD), a graphical display of air traffic, weather, alerts, and statistical information. To improve the efficiency and capabilities of the system, the Volpe Center developed a two-hour, computer-based instruction course for on-site training of air traffic managers. As part of its Spring/Summer 2001 plan for delay reduction, the FAA asked the Center to conduct a more intensive training program for Air Traffic Control Supervisors and Controllers-in-Charge at 21 FAA Air Route Traffic Control Centers around the country. This represented a new audience for ETMS beyond the traffic managers. The Volpe effort was managed by Dr. Sylvia Harris and supported by Ms. Justyne Johnson and Ms. Christine Risko, all of the Telecommunications Division. They assembled a team of eight trainers; each trainer completed 160 hours of preparation at the Volpe Center or FAA sites. This Volpe team provided training sessions and computer-based instruction to 665 TSD users at 16 sites over a five-month period. In order to achieve the best results, the team conducted small-group training sessions with no more than three students per trainer. The training sessions

received high marks from trainees and air traffic control personnel. In particular, the small-group sessions and the ability to receive immediate answers has helped the Air Traffic Control Supervisors and Controllers-in-Charge to use the TSD to its maximum capabilities. The training also gives the controllers the ability to adapt to new versions of ETMS, such as the new model rolled out in spring 2001 after training was completed.

Improved Airport Surface Surveillance System Demonstrated

While the Volpe Center and the FAA are using ETMS to improve in-flight air traffic management, other efforts are underway to improve the safety and efficiency of airport ground operations. The Volpe Center's Airport Surface Division is supporting the FAA's Safe Flight 21, a joint government/industry effort to implement advanced traffic management systems and technologies. To meet Safe Flight 21 surface-surveillance objectives at the Memphis International Airport, the Division is expanding on its highly successful Airport Surface Detection Equipment (ASDE) tracking, data fusion, and surveillance display system. The Center began overseeing the development of the ASDE system, which relies on radar data to locate planes and other vehicles on the tarmac, in the 1970s. Volpe staff continue to enhance the system, which has been implemented at several large airports. On June 13, Ms. Sharon Woods (lead software engineer) and Mr. David Setser (Volpe project manager), both of the Division, demonstrated the capabilities of a new system at Memphis International Airport. This new system, known as Automatic Dependent Surveillance-Broadcast (ADS-B), integrates the existing ASDE radar data with vehicle and flight data. Rather than just seeing a green dot on the screen, airport surface traffic controllers can view information about a plane's carrier affiliation, size, destination, and other characteristics. The presentation in Memphis, the first large-scale public demonstration of ADS-B, was co-sponsored by the FAA and Federal Express, which uses the Memphis Airport as one of its major shipping hubs. Because a large portion of arriving and departing Federal Express flights occur between midnight and 6:00 AM (when traffic controllers in the tower cannot see the airfield because of darkness), the development of a vehicle-specific traffic management system will significantly improve the efficiency of the ground operations.



Volpe's recent work to improve airport surface surveillance includes the ADS-B, which enables controllers to view information about each plane's carrier affiliation, size, destination, and other characteristics as well as its real-time surface location. ADS-B is a primary component of FAA's Safe Flight 21 architecture.

Safety



Promote the public health and safety by working toward the elimination of transportation-related deaths and injuries.

Volpe Staff Member Chosen for Committee on Weather Radar Technology Beyond NEXRAD

Dr. Thomas Seliga of the Surveillance and Sensors Division has been chosen to serve on the National Research Council's (NRC) Committee on Weather Radar Technology Beyond NEXRAD (Next Generation Radar). The NRC's Board on Atmospheric Sciences and Climate charged this Committee to study the state of knowledge regarding ground-based weather surveillance radar technology and to identify the most promising approaches for the design of the replacement for the present NEXRAD Doppler Weather Radar.

Weather radar, a vital element of the nation's surface-based observing systems for monitoring the state of the atmosphere, is critical for weather forecasting and warning. The current NEXRAD system of weather radars, which was designed in the 1980s, was procured in the 1990s via a joint-agency

procurement by the National Weather Service, the Federal Aviation Administration (FAA), and the U.S. Air Force. Its operation has proven critical to the quality and operational integrity of many related services, including severe weather monitoring and warning, and safe and efficient operation of the National Airspace System. Thus, there is great value in planning for replacement of the current system, including consideration of the benefits of new technologies. Dr. Seliga has been a radar meteorology pioneer in one of these technologies, the use of polarimetry to improve quantitative rainfall estimation, to detect hail, and to discriminate among various types of hydrometeors. He also has been actively involved in several FAA-related applications of weather systems that include the NEXRAD system. Dr. Seliga attended the first meeting of the Committee on April 23 and 24, 2001, in Washington, DC. The meeting was held to review current operational uses of the NEXRAD system by representatives of the National Weather Service, the FAA, and the Department of Defense, and to plan for future activities.

Volpe Submits Report on Grade Crossing Improvements to Congress (FRA)

As delays on roadways and at airports continue to increase, high-speed rail may offer a cost-effective alternative form of transportation. The Volpe Center actively supports the Federal Railroad Administration (FRA) in determining if higher train speeds in rail corridors will affect safety. As part of this effort, Volpe staff assessed recent grade crossing improvements on the State of North Carolina's high-speed rail "Sealed Corridor." The Sealed Corridor is one of several high-speed corridors included in an ISTEA/TEA-21 program for eliminating hazards at highway-railroad crossings. The assessment report was requested by Congress to determine if the grade-crossing safety improvements in North Carolina are effective and sustainable and could be implemented on other high-speed rail corridors in the country.

In May 2001, Ms. Anya A. Carroll of the High-Speed Ground Transportation Division transmitted to the FRA's Office of Railroad Development the final report titled "North Carolina 'Sealed Corridor' Phase I: U.S. DOT Assessment Report, Report to Congress." The report documents the benefits of the Sealed Corridor initiative and improvements completed at highway-rail grade crossings from March 1995 through September 2000. Improvements include median barriers, four-quadrant gates, longer gate arms, crossing closures, a grade separation, and a photo enforcement system. The study concluded that the improvements to grade crossings were cost effective and saved lives.

Furthermore, the study predicted that, even with increasing passenger train speeds in the future, savings in lives will continue and are sustainable through the year 2010, when train speeds along the corridor should reach 110 mph. The FRA and the Volpe Center will monitor the remaining phases of the Sealed Corridor project to determine effectiveness. Other high-speed rail corridors also will be analyzed in the future.



North Carolina DOT believes that median barriers have proven to be a low-cost investment with a high rate of return in safety at grade crossings. The barriers reduce drivers' ability to drive around lowered gates.



Four-quadrant gate systems are sometimes used with a median barrier to further deter violations.

Human and Natural Environment



Protect and enhance communities and the natural environment affected by transportation.

Proposing Alternative Designs to Help Preserve Natural and Cultural Resources (NPS)

For two years, the Volpe Center has supported the National Park Service (NPS) Northeast Region's Alternative Transportation Program. In May 2000, the Center was asked to assess traffic issues in and around the Valley Forge National Historical Park (NHP), which is located in the densely populated suburban area of Southeast Pennsylvania. The park, situated at a major transportation hub, is trisected by state roads that are used as daily commuter routes. Increasing traffic routinely congests the park road system, impairing the Park's natural resources and cultural artifacts, and detracting from visitors' enjoyment of the Park. The Pennsylvania Department of Transportation (PennDOT) is planning and

implementing several highway improvement projects in the area that will impact the Park, its visitors, and the surrounding area.

One of PennDOT's proposed projects is the replacement of the Old Betzwood Bridge, which would require right-of-way takings of Park land. Prior to Volpe's involvement, Valley Forge NHP signed a "4F" agreement acknowledging "no feasible and prudent alternative" to the project design. However, before signing a right-of-way release, the NHP asked the Volpe Center to study the situation.

Responding to a multitude of complex traffic issues, in a highly charged public policy arena of multiparty disputes and interests, Mr. David Spiller of the Service Assessment Division developed an alternative conceptual design that would have fewer adverse impacts and reduced land-takings at the Park. PennDOT also is proposing certain changes to a nearby interchange as part of the scope of work for the replacement of the Old Betzwood Bridge. Mr. Spiller analyzed that design and pointed out that, as planned, it leads to an awkward circulation pattern for traffic to and from a proposed large-scale development. He proposed an alternative design that includes a more direct access plan that is mutually acceptable and beneficial to the development, the town, and the Park. Mr. Spiller also suggested an additional study to fully test the proposed design alternative.

As a result of the Center's efforts, which were completed in April 2001, Valley Forge NHP, working with the NPS Washington Service Office and the Department of the Interior, has placed its consent to the 4F "on hold" and has proposed a regional study based on Volpe's work. The NHP, under the leadership of Arthur Stewart, Superintendent, and Robert Krumenaker, Deputy Superintendent, has been able to convince local stakeholders (e.g., the townships, counties, and metropolitan planning organization) of the necessity to rethink, in a more comprehensive fashion, regional transportation policy and capital improvement projects. The Center's development of innovative conceptual designs has been instrumental in this regard. This work demonstrates how innovative technical solutions can help achieve common ground and mediate differences among stakeholders.

The Center's assessment of traffic issues for Valley Forge National Historic Park demonstrates how innovative technical solutions can help achieve common ground and mediate differences among stakeholders.



AWARDS

- **Best of ITS 2001** The Volpe Center operates and maintains the Advanced Public Transportation Systems (APTS) Mobile Showcase as one aspect of its work in support of the Federal Transit Administration's (FTA) Intelligent Transportation Systems (ITS) Program. On June 5, 2001, the Mobile Showcase won ITS America's Annual "Best of ITS 2001" Award in the Education and Training Category. The Mobile Showcase travels the country demonstrating proven APTS technologies to the transit industry, decision makers, transit users, and the public in an interactive environment. The 48-foot, expandable exhibition trailer can serve as a research lab, classroom, and briefing facility. The Showcase was designed and developed for the FTA by the Volpe Center's Service Assessment Division. The technology onboard the Showcase is provided by more than 40 firms through Cooperative Research and Development Agreements with the Center. Mr. Matthew Rabkin of the Service Assessment Division, the project manager, works with a team comprised of federal staff and contractor support.
- **Flight Standard Service 2000 Good Friend** On May 31, 2001, Ms. Ann DiMare of the Aviation Safety Division received the Federal Aviation Administration's (FAA) Flight Standards Service 2000 Good Friend Award, which is given to a non-FAA person for promoting, enhancing, and supporting the Flight Standards Service safety mission. Ms. DiMare received the award for her contributions in designing, developing, and delivering the Safety Performance Analysis System (SPAS) Training. SPAS is an automated data analysis tool designed to support the FAA's Aviation Safety Inspectors in monitoring the performance of aviation entities and in identifying entities that pose a greater than normal safety risk.
- **Corporate Citizen of the Year** On April 25, 2001, the Volpe Center Community (Volpe and tenant federal employees as well as employees of the on-site contractors) received the Corporate Citizen of the Year Award from the Cambridge, Massachusetts, Chamber of Commerce. The award recognizes a business that demonstrates significant contributions to, involvement in, or distinguished community service to, the City of Cambridge. The other two finalists for the award were Harvard University and Akamai Technologies. The award acknowledges the more than 130 volunteers from the Volpe Center community who participate in its educational outreach programs - the Lunch Buddies Reading Program, the Cambridge Rindge and Latin High School Program, and the Adult Education/English as a Second Language Program. It is through their efforts that the Center has earned this prestigious award and made a positive difference in the Cambridge community.

PAPERS AND PRESENTATIONS

- The January – February 2001 issue of *Interfaces*, an international journal of the Institute of Operations Research and the Management Sciences, contained the paper, "Enhancements to the FAA Ground-Delay Program Under Collaborative Decision Making." The paper was written by Mr. Rick Oiesen, Automation Applications Division; Ken Howard, Arcon (a Volpe Center contractor); and four staff members from Metron, Inc. (an FAA contractor). The Volpe Center works with the FAA, the airline community, and others on Collaborative Decision Making, a high-priority initiative to reduce ground delays that enables the FAA and airlines to share information and decision making.
- On March 14, 2001, Dr. John Brewer of the Vehicle Crashworthiness Division presented an overview of his paper, "Effects of Angles and Offsets in Crash Simulations of Automobiles with Light Trucks," during a videoconference between the Division and National Highway Traffic Safety Administration (NHTSA) Headquarters. Volpe attendees included Mr. George Neat, Division Chief, and Mr. Lawrence Simeone, also of the Division. NHTSA attendees included Dr. Rolf Eppinger, Director of the National Transportation Biomechanics Research Center; Dr. W. Thomas Hollowell, Chief of the Crashworthiness Research Division; and Dr. Keith Brewer, Director of the Office of Human-Centered Research. The participants discussed possible methodologies for using computational models of varying complexity to recreate car crashes investigated in the Crash Injury Research & Engineering Network program.
- On April 9 and 10, 2001, Mr. Michael Dyer of the Technology Applications and Deployment Division attended the bi-annual Marine Bioinvasions Conference in New Orleans, Louisiana. He presented the paper "Performance Test of Alternative Ballast Water Treatment Systems," which reports results of field audits of four commercially available systems for onboard treatment to prevent or reduce the discharge of aquatic nuisance species in ship ballast into coastal waters. The audits were part of the Volpe Center's support of the U.S. Coast Guard's Aquatic Nuisance Species Program.
- Dr. Arthur Flores of the Environmental Measurement and Modeling Division participated in the Fourteenth Annual Meeting of the International Association for Chemical Testing, held in Williamsburg, Virginia, from April 22 through 26, 2001. Dr. Flores presented the paper "Relationship between Breath Temperature and Breath Alcohol Concentration." The Volpe Center is supporting the NHTSA Office of Traffic Injury and Controls Programs by studying techniques for measuring alcohol on the breath and in the blood of suspected drunk drivers.
- Dr. William Riddell of the Structures and Dynamics Division attended the Association of American Railroads Bureau of Explosives conference on Hazardous Materials Safety in Dallas, Texas, held May 14 through 17, 2001. As part of a session on tank car research, Dr. Riddell presented the results of research on fatigue crack growth behavior in tank car materials. This ongoing research is being conducted by the Volpe Center in support of the Federal Railroad Administration's (FRA) Rail Equipment Safety Program.

- In support of the FRA's Office of Research and Development program on Track Inspection Techniques, Dr. Theodore Sussmann of the Structures and Dynamics Division chaired a conference session and made a technical presentation at "Railway Engineering 2001" held in London, U.K., on April 30 through May 1, 2001. The conference covered many topics of interest to the FRA's research programs, ranging from railway track design and investigation to rail and track maintenance. Dr. Sussmann presented his paper, "Indications of Railway Track Performance Problems on Embankments from Ground Penetrating Radar," which was accepted for publication in the conference proceedings. In addition, Dr. Sussmann chaired the second session on Earthworks, in which three innovative techniques for improving track safety and stability were presented.
- In support of the FRA's Office of Research and Development, the Volpe Center conducts research into rail equipment crashworthiness that contributes to FRA requirements and regulations. Mr. David Tyrell of the Structures and Dynamics Division leads this effort. On May 2, 2001, Mr. Tyrell presented some of the results of this research at a symposium on rail equipment crashworthiness titled "What Can We Realistically Expect from Crashworthiness" held in London, U.K. The symposium, sponsored by The Institution of Mechanical Engineers, was conducted in response to several recent passenger train collisions. Mr. Tyrell presented "U.S. Rail Equipment Crashworthiness Standards," in the session on Crashworthiness Objectives, and another paper, "Rail Passenger Equipment Accidents and the Evaluation of Crashworthiness Strategies," in the session on The Future.
- The Volpe Center is supporting the U.S. Coast Guard through the technical review of proposed marine safety and environmental protection regulations and the development of regulatory assessments of their costs and benefits. In June 2001, Mr. Michael Dyer of the Technology Applications and Deployment Division delivered the Final Report "Regulatory Assessment, Vessel and Facility Response Plans: 2003 Mechanical Response CAPS, and Dispersant and In Situ Burning Measures" to Coast Guard Headquarters. The report will serve as the basis for the public rulemaking process.

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organizational and financing options, legal issues, public education and outreach, and project monitoring. The Center will convene a working group to study and develop the concepts identified at the symposium.

Recognizing that investment in "human capital" is vital to continued transportation improvements, the Center hosted the National Symposium on Innovations in Transportation Education and Workforce Development on June 21 and 22, 2001. This symposium provided an opportunity for transportation practitioners and educators to gather and discuss new concepts and techniques. Among the points of consensus: today's transportation environment requires an integrated, multilevel approach to education; continuing education opportunities help attract and retain top talent; and technology offers many opportunities for distance learning, but technology must be balanced with the human contact vital to personal and professional growth.

On August 7 and 8, 2001, the Center hosted the third symposium, Enabling Technologies and Transportation Innovation, to address the need for close and continuing interaction between the transportation community and those who conduct research and development of new technologies and applications. Sessions examined:

- Propulsion and fuel systems and issues related to national needs for environmental compatibility, energy availability, and efficiency: emission controls for diesel engines, implications of alternative power sources for highway vehicles, advances in fuel cells and batteries, and system engineering considerations for drive trains of hybrid vehicles.
- Micro-and nano-scale sensors and actuators: micro-electro-mechanical devices, nanotechnology-based sensors for transportation security applications, and nano-materials for structural applications.
- Information and communications technologies: powerful digital system applications in general aviation, technologies related to delivery of weather information, and the potential implications of pervasive wireless communications.
- Materials and structures: adaptive wing structures, sophisticated materials for vehicle construction (advanced steels, aluminum, and composites), and advanced processing and control in component manufacturing.

Discussions considered the promising areas of emerging technology, opportunities to accelerate the development of new applications, and potential policy or regulatory changes needed to foster new applications.

As a multidisciplinary institution with connections across all sectors, the Volpe Center is ideally suited to foster the discussions and debate that yield innovative improvements in transportation.



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