VOLPE center Highlights

March/April 2007

BOEING 747 LANDING AT KAI TAK AIRPORT, HONG KONG. The dramatic increase in air traffic worldwide is especially notable in the Asia-Pacific region. In support of the Federal Aviation Administration, Volpe Center staff collaborate with international colleagues—sharing initiatives and new technologies—to promote safe, secure, efficient, and environmentally sensitive air traffic services around the world. (© Russ Schleipman/CORBIS)

The Volpe Center has demonstrated an international leadership role in support of FAA.

U.S. Department of Transportation
Research and Innovative Technology Administration
Volpe National Transportation Systems Center

Aviation: Taking U.S. Solutions Worldwide

Supporting FAA's Global Aviation Efforts

As stated in its Flight Plan 2007 to 2011, one goal of the Federal Aviation Administration (FAA) is to increase the safety and capacity of the global civil aerospace system in an environmentally sound manner. FAA is a recognized global leader in improving safety and capacity as well as in implementing new technologies. The agency has also led the development of an effective international regulatory structure and provides a forum for addressing compatibility issues between the unique aviation systems of different nations.

Since its inception in the early 1970s, the Volpe Center has played an important role in supporting FAA's efforts, contributing to the development of air traffic management systems, to the improvement of navigational systems, and to the amelioration of environmental impacts of aviation. These activities have laid the groundwork

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Letter from the Director:

Volpe Center's International Work

"Transportation systems within and among nations are lifelines to economic growth, to freer trade, and to greater cultural exchange."

—Department of Transportation Strategic Plan 2003–2008

(Photo by Rich Gopen)

As stated in the Department of Transportation (DOT) Strategic Plan 2003–2008, global connectivity is a key strategic goal. The department seeks to facilitate a more efficient domestic and global transportation system that enables economic growth and development. As international trade and travel have become an increasingly important part of the transportation picture, the Volpe Center's role in supporting transportation modes internationally has seen corresponding growth.

In this issue of *Highlights,* the Focus article is about the Center's work for the Federal Aviation Administration in the international arena. In addition to DOT's goal of global connectivity, this work also supports DOT's strategic goals of safety, environmental stewardship, mobility, and security. Our staff has demonstrated that they can work seamlessly with their international colleagues.

In addition to our support to FAA, we are also proud of the work that we do to support other DOT agencies in the international arena. Our technical staff are well represented in international regulatory organizations, where they advocate for worldwide adoption of standards and regulations when this is desirable. The Center also provides direct services to several foreign governments. Our technical experts attend and present at international conferences, sharing research results and identifying best practices.

"We work towards finding and implementing lasting global solutions to transportation issues."

We work bilaterally with parallel organizations in individual countries where we have established working relationships. Within the past year, we have welcomed delegations from the United Kingdom, China, the Netherlands, and Israel. Each of these site visits has offered an opportunity to exchange information on new technologies and to focus on evolving areas of mutual interest.

The energy gained from the collaboration benefits everyone as we work towards finding and implementing lasting global solutions to transportation issues.

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(continued from page 1) for the Center's continuing support to FAA as the agency responds to growing aviation requirements both nationally and internationally.

This article showcases several of the Volpe Center's expanding international aviation support efforts. The Center has demonstrated an international leadership role in support of FAA in many key areas, including:

- International regulatory work
- Air traffic flow management
- Air traffic control modernization
- Environmental measurement, modeling, and analysis
- Human factors
- Wake vortex studies
- International Global Positioning Systems (GPS) efforts

International Regulatory Work

The Center plays an important role representing FAA in international aviation organizations that are concerned primarily with developing and implementing aviation policies. The Center's experts attend international as well as bilateral meetings and conferences; provide technical expertise, guidance; and present FAA's vision to the international community. For example, they are heavily involved in many of the activities of the International Civil Aviation Organization (ICAO). This United Nations agency was established in 1947 with a mandate to secure international cooperation on civil aviation issues and to establish Standards and Recommended Practices related to air navigation as well as to develop policies, regulations, technical manuals, and circulars. The Center also contributes in a similar way to the work of EUROCONTROL, the European Organization for the Safety of Air Navigation. This civil and military aviation organization is responsible for developing the European air traffic management system.

Air Traffic Flow Management

The Volpe Center is responsible for the development and daily operation of FAA's Enhanced Traffic Management System (ETMS), the primary system used to support the agency's mission to track, predict, and plan air traffic flow; to analyze effects of ground delays; and to evaluate alternative routing strategies. ETMS integrates weather and flight data from multiple sources and presents it in a graphical format, allowing FAA to anticipate and balance air traffic flow across the national airspace. ETMS initially focused on North American air travel. However, ETMS is now expanding into the international arena, both because FAA needs an interface with international aircraft arriving in the U.S. and in response to the growing needs of emerging markets and developing economies. In addition to providing essential technical support to ETMS sites in Canada, Mexico, Chile, Columbia, and Central America, the Center is involved in several of these initiatives:

- **Exchanging data with EUROCONTROL.** A key feature of a recent release of ETMS (8.3) is the ability to exchange data with EUROCONTROL. ETMS can

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VOLPE CENTER SUPPORTS INDIAN AVIATION. Mr. Nelson Keeler, Director, Office of Aviation Programs, with Mr. Ramalimgnam, Chairman of the Airport Authorities of India (AAI) in New Delhi, April 2007.

DELEGATION FROM CHINA'S BUREAU OF AIR TRAFFIC MANAGEMENT DURING A 2006 VISIT TO THE VOLPE CENTER. Mr. David Lev, Volpe Center Deputy Director, and Mr. Nelson Keeler, Director, Office of Aviations Programs, flank the delegation on the left and right, respectively. (Photo by Diane Wells)

now accept European departure messages, and EUROCONTROL data provides FAA traffic flow managers with a more accurate prediction of flight arrivals at U.S. airports.

- **Traffic flow management requirements of other nations.** The increasing worldwide demand for air travel and air cargo shipments has led to the need for formalized air traffic flow systems in some countries. Several countries have expressed serious interest in ETMS.
  - **India.** India's aviation industry is dealing with rapid growth. The Airport Authorities of India (AAI) understands that it must expand and improve its aviation infrastructure and services to address the dramatic increase in traffic that is predicted to occur over the next decade. The Indian Ministry of Civil Aviation has made the establishment of an advanced air traffic control system one of its top priorities, and FAA has agreed to contribute technical assistance. Last year, a Memorandum of Understanding (MOA) was signed between FAA and India to facilitate joint ventures. Volpe Center senior staff recently visited India and participated in discussions with the Ministry on how the United States could help India with its aviation flow control requirements. Volpe Center staff demonstrated ETMS to AAI representatives, who expressed a strong interest in it and wanted to establish a government-to-government relationship with the United States in order to implement a similar system in India. FAA proposed that it take the lead for the United States and use the Volpe Center as its federal partner for this work. The MOA that is currently in place could be used as the vehicle for the cooperative arrangement.
  - **China.** China's aviation sector is also experiencing rapid expansion. Cargo volume is expected to increase at a rate of 14 percent annually, while the annual number of air passengers is estimated to reach 270 million in 2007 compared with 138 million in 2005. A lack of infrastructure as well as limited civil air space could hamper growth and increase air congestion. Chinese authorities realize the need to address these issues, and the Volpe Center has established a fruitful dialogue with representatives of that country. In June 2006, a delegation from China's Bureau of Air Traffic Management visited the Volpe Center in order to learn about best practices for air traffic management and about ETMS. The Bureau wishes to maintain a working relationship with the Volpe Center as it moves forward with building a new air traffic management facility in China.

Air Traffic Control Modernization

The Volpe Center is working with FAA in applications of aviation surveillance technologies to improve efficiency and safety in the national airspace system. The Volpe Center

has been FAA's principal program support arm in implementing the Automatic Dependent Surveillance-Broadcast (ADS-B) technology, which uses Global Positioning System (GPS) satellite signals to provide air traffic controllers and pilots with accurate information that will help to keep aircraft separated safely in the skies and on runways. In testimony before the Committee on Transportation and Infrastructure, Subcommittee on Aviation on the Future of Air Traffic Control Modernization Aircraft, FAA Deputy Administrator Robert Sturgell stated that "transponders receive GPS signals and use them to determine the aircraft's precise position in the sky, which is combined with other data and broadcast out to other aircraft and controllers. When properly equipped with ADS-B, both pilots and controllers will, for the very first time, see the same real-time displays of air traffic, thereby substantially improving safety." ADS-B is a primary component of FAA's Safe Flight 21 architecture; the agency is currently implementing it nationally and advocating its use internationally. The Volpe Center is supporting the international implementation of ADS-B in several locations:

- **Gulf of Mexico.** Because current land-based, long-range radar systems operated by the United States and other nations do not provide surveillance coverage along entire international flight routes for aircraft traveling from the United States to Mexico and farther south, air traffic controllers must use oceanic separation standards (e.g., 100 nautical miles), thereby decreasing capacity and efficiency. The Volpe Center is supporting FAA's efforts to implement ADS-B in the Gulf of Mexico to resolve these limitations.
- **Safe Skies for Africa.** The World Bank and the FAA are involved in an exciting initiative, Safe Skies for Africa, in which a key component is to introduce ADS-B to East African countries. Volpe Center staff have traveled to Kenya, Tanzania, and Uganda to evaluate the potential implementation of ADS-B in those countries. This is part of a larger effort to support the development of aviation infrastructure in those nations. ADS-B implementation is especially significant for developing countries where radar coverage is spotty at best, and the technology also provides situational awareness to pilots.
- **ADS-B standards.** Implementation of ADS-B 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 meetings of international organizations such as EUROCONTROL 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. Center staff recently traveled to India, Japan, Australia, Canada, Greece, and China to participate in discussions about the technology and its implications.

AFRICAN AVIATION IMPROVEMENTS. FAA's Safe Skies for Africa initiative is designed to improve aviation safety and harmonize U.S.-Africa aviation ties. The Volpe Center's role relates to improving regional air navigation services in Africa by using modern satellite-based navigation aids and modern communication technology. (iStockPhoto.com)

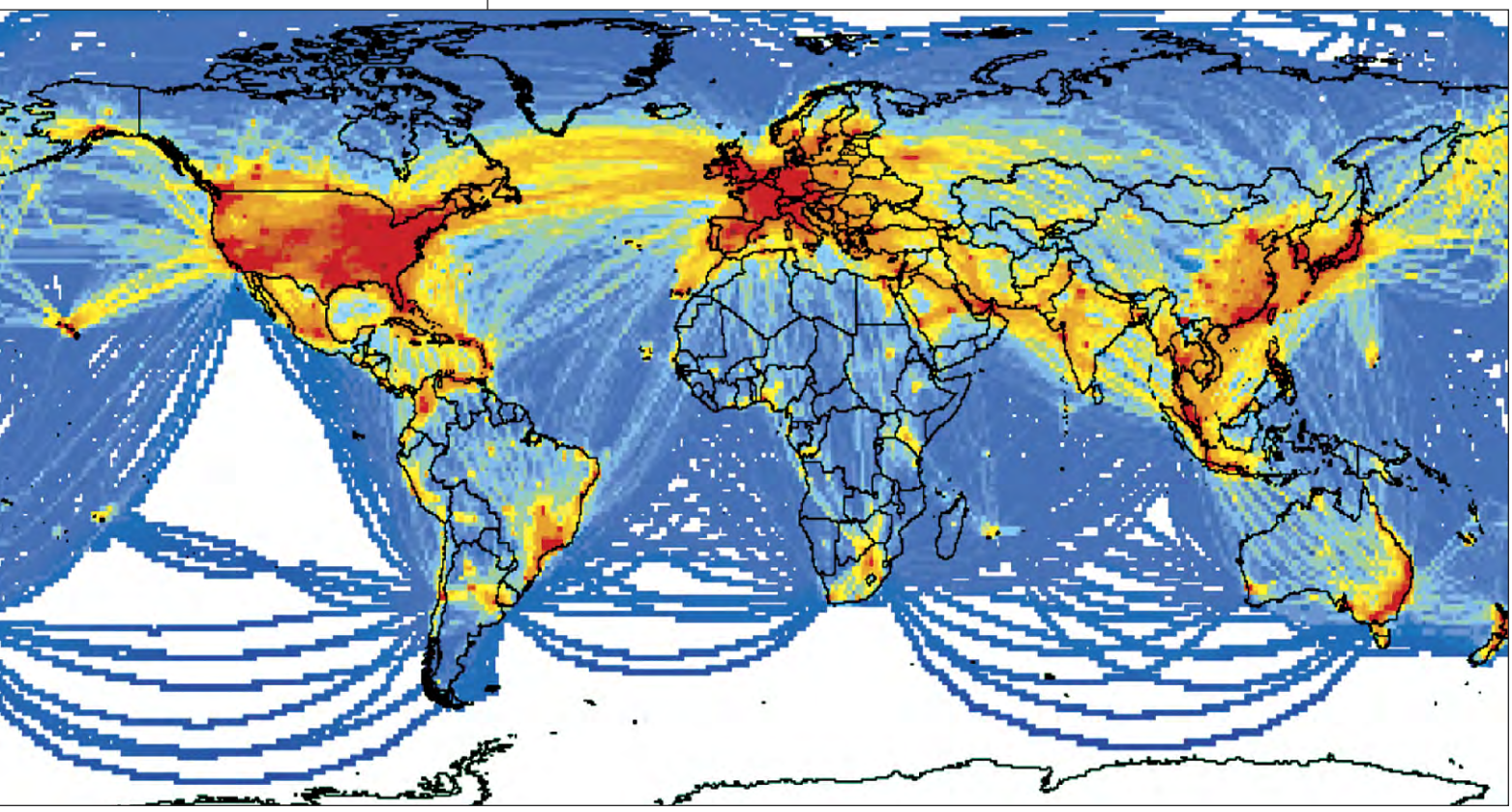
Environmental Measurement, Modeling, and Analysis

The Center has been providing support to FAA in the area of environmental measurement and modeling since the mid-1970s. This work includes the continued design and development of FAA's Integrated Noise Model, which has over 800 users in more

than 46 countries, and is used for modeling aircraft noise in the vicinity of airports. More recently, the Center designed and developed for FAA the System for Assessing Aviation's Global Emissions (SAGE), which provides input to stakeholders involved with ICAO, as well as the United Nations Framework Convention on Climate Change (UNFCCC). As international concern for the human and natural environment grows, the potential impacts of air transportation, such as noise and air quality, are receiving greater interest. The environment is seen as a key barrier to aviation growth in the U.S. as well as globally. As stated in its Flight Plan 2010, FAA is committed to "continued global leadership in environmentally responsible aviation." Environmental analysis has become an integral component in the planning, development, and deployment of aviation systems. The Volpe Center is internationally recognized for its expertise in environmental measurement and modeling. FAA's Office of Environment and Energy is currently integrating all of their environmental modeling tools into a single system, which will be capable of assessing the interdependencies between aviation-related noise and emissions.

- **FAA's Aviation Environmental Design Tool (AEDT).** The Volpe Center is leading FAA efforts to develop AEDT, a multifaceted, comprehensive tool that will enable integrated noise and emission modeling on a scale ranging from local to global. As research tools and approaches have become more sophisticated, the interdependencies of noise and emissions have been acknowledged, though they are not yet fully understood. AEDT will integrate FAA's local and global noise and emissions tools into a single modeling framework. Local models will support local and regional regulatory and planning efforts while global models will support national and international policy development; all models will use the same data sources to help ensure accuracy, transparency, and efficiency. AEDT incorporates

AVIATION ENVIRONMENTAL DESIGN TOOL (AEDT), SYSTEM FOR ASSESSING AVIATION'S GLOBAL EMISSIONS (SAGE). In support of the FAA's Office of Environment and Energy, the Volpe Center has led the design and development of a global fuel burn and emissions assessment tool. AEDT/SAGE is used to predict fuel burn and emissions for all commercial aircraft in the world—more than 30 million flights annually. The FAA's objective is for AEDT/SAGE to be an internationally accepted model used for evaluating operational-, policy-, and technology-related scenarios to estimate global aircraft emissions. This image depicts worldwide gridded fuel burn plots of commercial flights.



legacy tools, including those developed previously by the Volpe Center, e.g., INM and SAGE. The tool incorporates several modules: Aircraft Acoustics, Aircraft Emissions, Emissions Dispersion, and Fleet and Operations (for forecasting). AEDT is part of a larger effort by FAA and the National Aeronautics and Space Administration (NASA) to develop an integrated suite of analytical tools. Other tools will include the Environmental Design Space (for assessing aircraft technologies) and Aviation Environmental Portfolio Management Tool (APMT), for assessing economics. Together, these tools will provide valuable decision-making capabilities that can help government and industry to reach agreement and in turn can facilitate international agreements on standards, recommended practices, and mitigation options for international policymaking.

- **Global acceptance of noise and emissions modeling.** FAA is advocating that AEDT become an internationally accepted model for assessing aviation noise and emissions interdependencies. Volpe Center staff regularly represent FAA and participate in meetings of international organizations to explain the new model and to build consensus among stakeholders. The International Civil Aviation Organization's Committee on Aviation Environmental Protection is charged with setting environmental standards for civil aviation. The Volpe Center actively participates on the Committee, including chairing the Modeling and Database Task Force, with a representative from Switzerland. Volpe Center representatives also actively work with their counterparts in EUROCONTROL on issues related to modeling as well as global database development.
- **Novel research supporting the models.** The Volpe Center is assisting FAA with research in several areas, which is leading to improvements in the modeling tools. For example, the Volpe Center recently developed the First Order Approximation (FOA) for estimating particulate matter emissions from aircraft. The FOA was internationally accepted for use by ICAO/CAEP in 2006. Also, in 2006 the Society of Automotive Engineers' approved an international standard on the lateral attenuation of aircraft sound, coauthored by the Volpe Center and the U.K. Civil Aviation Authority.

ELECTRONIC FLIGHT BAGS. Instead of traditional flight bags loaded with paper documents such as checklists, operating manuals, and navigation publications, many flight crews are bringing aboard Electronic Flight Bags (EFBs) in the form of handheld, laptop, or tablet computers, as shown above. Details on the Center's EFB work are available at *http://www.volpe.dot.gov/hf/aviation/efb/index.html*.
(Photo courtesy of Teledyne Controls)

Human Factors

Volpe Center researchers analyze and address human factors considerations in the design and evaluation of communications and display technologies in aviation. This research is particularly pertinent to the international aviation community, where differences in language and standards may exacerbate communication problems. The Volpe Center has an international reputation as an expert in this field and routinely represents FAA at meetings where these issues are discussed.

- **Flight symbology research.** Electronic displays that show aeronautical navigation information range from small handheld devices to installed displays. Although there are industry-recommended standards for symbols on these displays, the standards are not always followed. Volpe Center researchers are working with the SAE International G 10 Aeronautical Charting Committee in an effort to update an industry recommendations document on symbology. Results of this research are intended to be of use to FAA, industry, ICAO, and other civil aviation

authorities. These organizations may reference the symbology recommendations developed for SAE International in their own guidance documents. The most recent study has received the support of the International Federation of Air Line Pilots Associations (IFALPA), which is helping the Volpe Center to gather data from many international pilots.

- **Electronic Flight Bags.** Rather than traditional flight bags loaded with paper documents such as checklists, operating manuals, and navigational publications, many flight crews are bringing aboard Electronic Flight Bags (EFBs) in the form of handheld, laptop, or tablet computers. FAA, system designers, and customers all recognize that EFBs are sophisticated devices that could affect pilot performance. As a result, human factors issues have received considerable attention from the EFB community. In support of FAA, the Volpe Center has developed guidelines for the design and evaluation of EFBs. Volpe Center experts regularly attend international conferences to share their human factors insights on the use of electronic display devices in the cockpit.
- **Flight simulators.** Flight simulators are an indispensable tool in airline pilot training. As part of an international working group sponsored by the Royal Aeronautical Society, Volpe Center human factors experts are making important contributions to ICAO's Flight Simulator Standards Harmonization Effort. The result of this effort will be a revision and expansion of the Manual of Criteria for the Qualification of Flight Simulators (ICAO Doc. 9625) and an addition to the Procedures for Air Navigation Services.
- **Air traffic separation.** FAA is adopting the separation conformance metric, developed by Volpe Center human factors researchers, as a new way to classify the severity of loss of standard separation between aircraft. Loss of separation refers to loss of the minimum required safe distance between an aircraft and other objects on the runway surface. This metric categorizes the severity of loss of separation as a function of the percentage of required separation. It provides an objective assessment of the degree to which separation standards are maintained. NAV CANADA, a private corporation that owns and operates Canada's civil air navigation system, has proposed the use of the metric as an international standard.

Wake Vortex Studies

Aircraft wake vortices, which are disturbances in the air caused by aircraft motion, have been responsible for a number of deadly aviation accidents. Volpe Center scientists have made a significant contribution to the international aviation community's understanding of the behavior of vortices when aircraft take off or land. The Center's research is cosponsored by FAA and NASA. FAA and a consortium of European organizations—including EUROCONTROL, DFS, and ONERA—currently participate in a joint wake turbulence measurement program for which Volpe Center scientists conduct measurement and analysis activities. The program's goal is to increase airport arrival and departure rates by reducing operating restrictions aimed at mitigating hazards posed by aircraft wakes without increasing the risk of an incident or accident. U.S. stakeholder groups include airport operators, major air carriers, pilot organizations, and air traffic controller organizations. Volpe Center researchers have played a

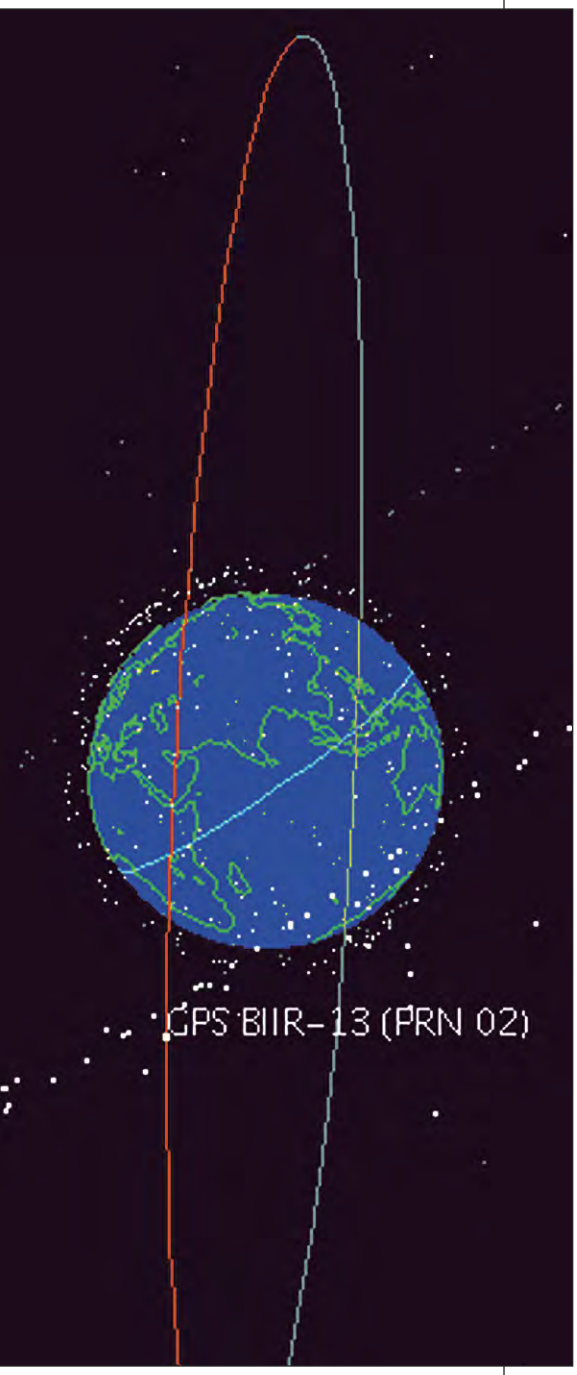
key role in developing and evaluating wake vortex prediction and measurement technologies. One such sensor currently being utilized is the light detecting and ranging (LIDAR) system, which measures both wind shear and wake vortex. LIDAR is an optical remote sensing technology that measures properties of scattered light to determine the range and other information about a distant target; it has been shown to be especially effective at detecting dry wind shear. FAA and EUROCONTROL have agreed to share expertise and resources for conducting LIDAR wake turbulence measurements in Europe, specifically in Frankfurt. Other sites, such as Paris and London, are currently under consideration. Volpe Center staff are participating in these studies. Center personnel are also actively studying the wake vortex challenges of large aircraft such as the new Airbus A380.

WAKE VORTEX RESEARCH. Aircraft in flight create wake turbulence. The most notable feature of wake turbulence is a pair of counter-rotating cylindrical air masses, called wake vortices, that result when aircraft generate lift. Wake vortices can be a potential hazard to following aircraft. During a long history of work on the wake vortex problem, the Volpe Center's researchers have developed techniques for detecting and tracking vortices. Vortices are visible in this photo of early Volpe Center research into wake turbulence. (Photo from the Volpe Center's Technical Reference Center)

Runway Incursions Classifications. Runway incursions are defined by FAA as "any occurrence in the airport runway environment involving an aircraft, vehicle, person, or object on the ground that creates a collision hazard or results in a loss of required separation with an aircraft taking off, intending to take off, landing, or intending to land." Runway incursions have been responsible for several collisions that have involved injuries and loss of life. Volpe Center runway incursion experts designed the Runway Incursion Severity Classification (RISC) scheme to provide a consistent assessment of runway incursion events. This is a critical component of measuring risk, where risk is a function of the severity of the outcome and the probability of recurrence. The model is currently being validated by FAA and other countries and is being considered by ICAO as a tool for standardized ratings of runway incursions. A working version of the model has been developed for use by Air Services Australia.

International Global Positioning System (GPS) Efforts

The Volpe Center is working with a number of international organizations to better integrate the GPS satellite navigation system into civil aviation. These efforts have increased recognition of the Center's GPS capabilities and have offered opportunities for other countries to capitalize on advances in GPS transportation applications and thus to increase safety and efficiency and facilitate trade. Introduction of the Russian Global Navigation Satellite System (GLONASS) and the European GALILEO system in conjunction with the use of GPS could bring additional potential improvements to aviation.



GPS SATELLITE. The Volpe Center supports the development, testing, and implementation of many civil aviation applications of Global Positioning System (GPS) technology. This image depicts the orbit of a GPS satellite—one of a constellation of at least 24 that transmit precise microwave signals that can be picked up by a GPS receiver to determine location, speed, and direction. (Image from *http://science.nasa.gov/realtime/jtrack/3d/JTrack3D.html*)

In addition, the Volpe Center supports individual countries in the introduction and utilization of GPS:

- **Canadian Navigation Services.** The Center supports the Canadian Civil Air Navigation Services (NAV Canada) in the integration of a Wide Area Augmentation System (WAAS) service volume model with the Canadian Notice to Airmen (NOTAM) system for predicting and reporting when WAAS will be unavailable for use by aircraft operating under instrument flight rules. WAAS is the system of ground stations and geosynchronous satellites that provide GPS signal corrections, thus significantly improving GPS position accuracy. Moreover, WAAS provides aircraft with information on the integrity of GPS signals.
- **Air Service Australia.** The Center provided implementation support to Air Service Australia's ADS-B Availability Prediction System. This system assesses the integrity of GPS signals based on aircraft use of Receiver Autonomous Integrity Monitoring (RAIM) and provides the capability to distribute GPS/ADS-B integrity outage information to aircraft via a network of ground-based VHF radio transmitters. ADS-B is a cost-effective alternative to radar for the sparsely populated interior of the Australian continent, which currently lacks surveillance service.
- **Brazil's Department of Air Space Control (DECEA).** The Center is helping Brazil develop and deploy the first real-time Global Navigation Satellite System (GNSS) performance monitoring capability for operational use that is not part of an augmentation system, such as WAAS. The system will be able to monitor the operational status of a GNSS system in real time, as well as predict its future performance. GNSS is the standard generic term for satellite navigation systems that provide autonomous geospatial positioning with global coverage.
- **Improving air navigation safety in Africa.** This year, on behalf of FAA, the Volpe Center participated in an ICAO Communications, Navigation, and Surveillance/Air Traffic Management meeting in Abuja, Nigeria. The Center discussed implementation of a GPS Notice to Airmen (NOTAM) system to support flight planning and provide training in the use of a GPS outage prediction tool (developed by the Volpe Center) that supports generation of aeronautical information. Aviation representatives from each country in Africa participated. As part of the Safe Skies for Africa initiative, this effort would encourage the expeditious implementation of the use of GPS to improve air navigation safety.

Conclusion

In response to the increasing demand for air travel, FAA and several partner agencies have responded with the Next Generation Air Transportation System (NGATS) (also known as NextGen). The Volpe Center is well positioned to support FAA in meeting the technical and managerial challenges of this transformation, both nationally and internationally. A key element of this challenge is to work toward one seamless, standardized, international airspace system. To this end, FAA is working with the international community, with Volpe Center staff members providing their expertise on the multiple aspects of this effort. ■

GLOBAL CONNECTIVITY

Iraq Railroad Reconstruction

The Volpe Center is proud to be part of a major reconstruction endeavor for Iraqi Republic Railways. Supporting the U.S. Department of State's Iraq Reconstruction Management Office funded by the Iraq Relief and Reconstruction Fund (IRRF), the Volpe Center is engaged in an effort to significantly upgrade the Iraqi railways communications system.

By 2003, Iraqi railways had been torn apart. With bridges and signaling in disarray and no reliable means of communication between trains and stations or among trains, instructions for trains' movements were often delivered by taxi. This situation contributed to several head-on accidents and severely limited the number of trains that could operate with any degree of safety. Resumption of normal railway service is an economic necessity supporting international commerce and exchange in Iraq.

With communications a top priority, it became clear that conventional signaling was not a realistic option, and a decision was made to pursue the installation of a Communications-Based Train Control (CBTC) system. The system requires use of a digital microwave radio communications network (DMRCN) consisting of microwave radio base stations, transmission towers, telecommunications equipment shelters, and auxiliary power systems. The DMRCN will serve as the railway's backbone communications link for both voice and data transmission and will be an essential component of the CBTC for Iraqi Republic Railways (IRR).

IRAQ RECONSTRUCTION. The Volpe Center is supplying vital technical support for the development of a microwave system that will provide backbone communications links for the Iraqi Republic Railways. The map shows the primary railroads.

The Volpe Center was selected to develop specifications for the new system, to manage the contract awards and the procurement of equipment, and to oversee system installation. The network will initially consist of 33 sites from the Syrian border through Baghdad to the port facility at Um Qasr. Um Qasr is Iraq's primary port and the key rail transport link for imports and exports and is vital for both passengers and freight. This $41 million dollar project will combine the latest communication-based train control system technology with reliable microwave radio technology over 1,000 km of track. The interoperability of the two systems was verified as part of this contract and when completed will be the longest CBTC/microwave-based system in the world.

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The system will provide computer-aided dispatching of trains from the Central Control Office in Baghdad. Authorization for trains to occupy tracks between stations will be conveyed automatically and displayed on a screen in the cab of the locomotive. A GPS tracking system on each locomotive will provide location information to the train dispatcher.

Successful accomplishment of all stages of this large-scale, highly visible undertaking will draw on the Volpe Center's unique combination of project-management and acquisition expertise, along with its decades of experience with railroad equipment and its understanding of new communications technologies. Center staff have already faced the challenges of working in Iraq, where they have adapted methods to meet the needs of the ever-changing environment. They have established good working relationships with Iraqi railroad managers and also have worked effectively with the major U.S. contractor as well as subcontractors from Turkey, Jordan, and Iraq.

Mr. James Lamond of the Rail and Transit Systems Division leads the Volpe Center effort and is actively involved in project reviews and troubleshooting as needed. Other key Volpe Center participants are Mr. Fred Mottley of the Rail and Transit Systems Division and Mr. Orin Cook and Mr. Dan Leone of the Acquisition Division. ■

PUBLISHED AND PRESENTED

2006 International Level Crossing Safety and Trespass Prevention Symposium. Volpe Center staff presented papers at the 9th International Level Crossing Safety and Trespass Prevention Symposium in Montreal, Canada, September 10–14, 2006. The theme of the conference, "Partners in Safety," comprised the accomplishments and challenges of railway safety research, human performance, and the future vision of crossing safety and trespass prevention programs. Two hundred and fifty international delegates from 35 countries discussed advances in level grade crossing technology and operations in order to share international dialogue on these issues. (More about the event may be found at *http://www.levelcrossing2006.com*)

- "North Carolina DOT Traffic Separation Studies – Assessment," Mr. Patrick Bien-Aime of the Rail and Transit Systems Division.
- "Functional Concept Requirements and Testing of Intruder and Obstacle Detention Systems (IODS)," Ms. Anya Carroll of the Rail and Transit Division.
- "State-of-the-Art Technologies for Obstacle/Intrusion Detection for Railroad Operations," Mr. Marco daSilva of the Advanced Safety Technology Division.
- "The Effect of Locomotive Horn Characteristics on Motorist Detection," Ms. Gina Melnik of the Human Factors Division, and coauthored by Dr. Stephen Popkin of the same division and Dr. F. A. Russo of the University of Toronto.
- "Impact of Active Warning Reliability on Motorist Compliance at Highway-Railroad Grade Crossings," Dr. Jordan Multer of the Human Factors Division, and coauthored by Dr. Monica Gil of Sikorsky Aircraft.
- "New Technologies in Intelligent Transportation Systems for Highway-Rail Intersections," Mr. Steven Peck of the Rail and Transit Systems Division, and coauthored by Mr. Paul Bousquet of the same division.

- "Result of Risk Methodology Data Acquisition Methods and Assessment for a Proposed High-Speed Rail Corridor in California," Mr. Adrian Hellman of the Rail and Transit Systems Division, and coauthored by Ms. Anya Carroll of the same division and Mr. Gary Baker, then of the Federal Railroad Administration, now of the Environmental Measurement and Modeling Division.
- "Public Education and Enforcement Research Study (PEERS)," Ms. Suzanne Sposato of the Rail and Transit Systems Division.
- "North Carolina 'Sealed Corridor' Phase I: US DOT Assessment," Ms. Anya Carroll of the Rail and Transit Division, and coauthored by Mr. Jim Smailes of the Federal Railroad Administration, Office of Research and Development.

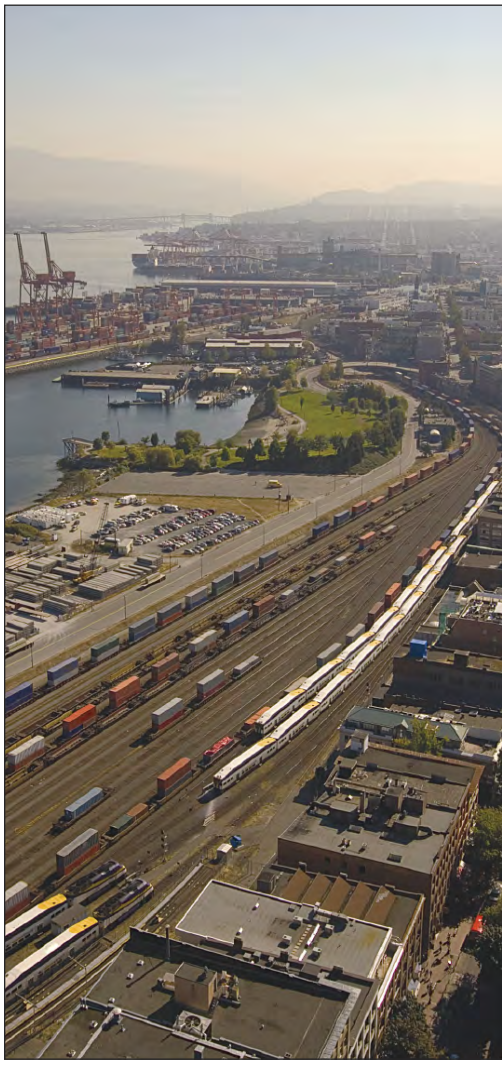
Canadian Participation in FRA Railway Safety-Related Research. The results of recent Volpe Center research have been posted on the Federal Railroad Administration (FRA) website in the Research Results section, which describes significant FRA R&D projects. Two of these describe FRA Human Factors Research and Development Program and Alternative Safety Measures Program projects designed to evaluate whether safety programs improve safety outcomes and the underlying safety culture, and to conduct implementation and impact evaluations of promising safety programs in the railroad industry. The Canadian Auto Workers Union (CAW) and Canadian Pacific Railway (CPR) have provided data for this evaluation. Two studies, describing the work of Ms. Mary Lee and Dr. Joyce Ranney of the Human Factors Division, are listed below and can be accessed by the provided links:

- *Canadian Pacific Railway Investigation of Safety-Related Occurrences Protocol Considered Helpful by Both Labor and Management,* Research Results Report No: RR 06-13. *http://www.fra.dot.gov/downloads/Research/rr0613.pdf*
- *Canadian Pacific Railway Mechanical Services' 5-Alive Safety Program Shows Promise in Reducing Injuries,* Research Results Report No: RR 06-14. *http://www.fra.dot.gov/downloads/Research/rr0614.pdf*

Human Factors Evaluation of Electronic Flight Bags. For the Federal Aviation Administration, Dr. Divya Chandra and Dr. Michelle Yeh, both of the Human Factors Division, produced *A Toolkit for Evaluating Electronic Flight Bags.* The goal of these tools is to help streamline and standardize EFB human factors assessments by the FAA (DOT-VNTSC-FAA-06-21; DOT/FAA/AR-06/44). *http://www.volpe.dot.gov/hf/aviation/efb/docs/toolkit0906.pdf*

Improving Safety Culture in the Railroad Industry. Dr. Joyce Ranney of the Human Factors Division participated in the American Evaluation Association (AEA) Conference Federal Railroad Administration (FRA) Research and Evaluation Studies and the New Risk Management Program in Portland, Oregon. The panel reported on three FRA-sponsored research and evaluation studies that encourage the use of precursor safety data to prevent future injuries and accidents. Dr. Ranney presented "The Federal Railroad Administration's Research and Development Agenda to Improve Safety and Safety Culture in the Railroad Industry," written by Mr. Michael Cohen of the FRA. Dr. Ranney also presented preliminary findings in "Improving Safety Culture in the Railroad Industry: Overview of Results to Date from Three Related Evaluations."

Air Transport and Human-Automation Interaction. Dr. Thomas Sheridan of the Human Factors Division presented "Next Generation Air Transportation Systems: Human-Automation



VANCOUVER RAIL YARD: SAFETY DATA ON HIGHWAY-RAIL USER BEHAVIOR. For FRA, Volpe Center staff have been working with Canadian authorities to evaluate safety data. (iStockphoto.com)

CONFIDENTIAL CLOSE CALLS REPORTING SYSTEM. For FRA, the Volpe Center is engaged in implementing a voluntary, confidential demonstration program for railroad carriers and their employees to report close calls without receiving disciplinary action.

Interaction and Organizational Risks," at the Human Automation Research meeting on resilience engineering held at the Ecole des Mines at Juan les Pins, France. Resilience engineering is an approach to safety management and human error analysis that deals mainly with organizational structures and practices, seeking new ways to detect that a complex technological system is drifting toward the margins of safety, and to help it be prepared to adapt to surprises and undesigned-for situations while still maintaining stability in performing its expected functions. The research was sponsored by the National Aeronautics and Space Administration.

Confidential Reporting Systems. Dr. Jordan Multer of the Human Factors Division gave two presentations at the 4th International Confidential Reporting Systems User Forum in London, England. At the plenary session, he presented "Railroad Human Factors Program Overview." In a session on using reporting systems to drive change, he presented "Creating a Learning Culture Through Confidential Reporting in the U.S. Railroad Industry." The Volpe Center's participation in this forum supported the Federal Railroad Administration's effort to provide the railroad industry with better tools to manage safety.

High-Speed Rail Risk Analysis Methodology. For the Federal Railroad Administration, Mr. John Choros of the Structures and Dynamics Division, Mr. Adrian Hellman and Ms. Anya Carroll, both of the Rail and Transit Systems Division, Mr. Gary Baker of the Environmental Measurement and Modeling Division, Ms. Marsha Haines of EG&G, Inc. (a Volpe Center contractor), and Mr. Jon Anderson, formerly of EG&G, coauthored *San Joaquin, California, High-Speed Rail Grade Crossing Data Acquisition Characteristics, Methodology, and Risk Assessment* (DOT-VNTSC-FRA-06-02; DOT/FRA/ORD-06/02). This is in support of a long-standing effort to estimate the probability of a collision at highway-rail grade crossings and is based on a substantial national database maintained by FRA. The report can be downloaded at *http://www.fra.dot.gov/downloads/research/ord0602.pdf*

International Forum on Railroad Safety. Mr. David Tyrell of the Structures and Dynamics Division presented "A Train-to-Train Impact Test of Crash Energy Management Passenger Rail Equipment," which described the results of a test conducted in March 2006 in Pueblo, Colorado, at the 6th International Symposium on the Passive Safety of Rail Vehicles in Berlin, Germany. The paper was coauthored by Mr. Eloy Martinez of the Federal Railroad Administration (formerly of the Volpe Center). The Colorado test was the eighth in a series of full-scale train tests conducted as part of the Federal Railroad Administration's rail passenger equipment safety research program.

Improving Rail Car End Frame Crashworthiness. Mr. Eloy Martinez of the Federal Railroad Administration (formerly of the Volpe Center) along with Mr. Ronald Mayville of Mayville and Associates and Mr. Richard Stringfellow of TIAX published the final report *Development of Conventional Cab Car End Structure Designs for Full Scale Testing* (DOT-VNTSC-FRA-07-01, DOT/FRA/ORD-06/20), testing current state-of-the-art cab car design. *http://www.fra.dot.gov/downloads/Research/ord0620.pdf*

Safety Data on Highway-Rail User Behavior. Ms. Suzanne Sposato, Mr. Patrick Bien-Aime, and Ms. Minakshi Chaudhary, all of the Rail and Transit Systems Division, wrote the final report, *Safety of Highway-Rail Grade Crossings: Public Education and Enforcement Research Study.* (DOT-VNTSC-FRA-06-03, DOT/FRA/ORD-06/27). This project was a collaborative effort between the Federal Railroad Administration (FRA), the Illinois Commerce Commission, and local communities. The report can be downloaded at *http://www.fra.dot.gov/downloads/Research/ord0627.pdf*

Submission of Alternative Fuels Report to Congress. On December 7, Ms. Mary E. Peters, Secretary of Transportation, signed and submitted to the U.S. House Committee on Transportation and Infrastructure and the U.S. Senate Committee on Banking, Housing, and Urban Affairs a report entitled *Alternative Fuels Study: A Report to Congress on Policy Options for Increasing the Use of Alternative Fuels in Transit Vehicles.* This report details environmental benefits, existing barriers, current incentives, and policy recommendations related to increasing alternative fuels use in public transportation nationwide. The final report was based on a draft written by Mr. Greg Ayres with support from Mr. Kevin Green and Mr. Neil Meltzer, all of the Advanced Safety Technology Division, with additional analysis done by Dr. Don Pickrell of the Economic and Industry Analysis Division. *http://www.fta.dot.gov/documents/Alternative_Fuels_Study_Report_to_Congress.pdf*

Feasibility of an Automobile "Black Box." Mr. Marco daSilva and Dr. Wassim Najm of the Advanced Safety Technology Division coauthored *Development of Collision Avoidance Data for Light Vehicles: Near-Crash/Crash Event Data Recorders* (DOT-VNTSC-NHTSA-06-03). The report assessed the current status of motor vehicle near-crash and crash Event Data Recorder technology for the U.S. Department of Transportation's (DOT's) Intelligent Vehicle Initiative/Intelligent Transportation System program. *http://www.volpe.dot.gov/library/published/nc-edr_final_020107.pdf*

NEAR-CRASH/CRASH EVENT DATA RECORDERS. The Volpe Center final report reviews low-cost options for "black boxes" on automobiles.
(Photo by Marco daSilva)

Volpe Center Contributes to Conference on Weather. The American Meteorological Society's 87th annual meeting was held in San Antonio, Texas, from January 13–18, 2007. The annual meeting hosts several other meteorological conferences, and two Volpe Center technical experts presented their papers at these meetings:

- "Evaluation of Wind Algorithms for Reporting Wind Direction for Use in Air Traffic Control Towers," Dr. Thomas A. Seliga of the Advanced Communication, Navigation, and Surveillance Technologies Division and Mr. David A. Hazen of L-3 Communications Titan Group, was presented at a joint poster session (between the 16th Conference on Applied Climatology and the 14th Symposium on Meteorological Observations and Instrumentation). *http://ams.confex.com/ams/pdfpapers/116901.pdf*
- "Analysis of Weather Events on U.S. Railroads," Mr. Michael A. Rossetti of the Advanced Communication, Navigation, and Surveillance Technologies Division, was presented as part of the 23rd Conference on Interactive Information Processing Systems (IIPS). *http://ams.confex.com/ams/pdfpapers/118791.pdf*

Volpe Center Explores Aircraft Separation Standards. The 45th American Institute of Aeronautics and Astronautics (AIAA) Aerospace Sciences Meeting and Exhibit met on January 8–11, 2007, in Reno, Nevada. The conference provides scientists and engineers from industry, government, and academia with a forum for discussing new milestones for flight.

- Ms. Melanie Soares of the Advanced Communication, Navigation, and Surveillance Technologies Division and Dr. James Hallock, Senior Technical Expert for Air and Space Transportation Safety with the Office of Demonstration and Deployment Programs, presented "Is the B757- 300 Really a 'Heavy' Aircraft?" (AIAA-2007-288) in the Wake Vortices and Turbulence session. The study examined the behavior of vortices in the B757-200 and the B757-300 (the latter having an increased maximum certificated takeoff weight) during approach/landing operations and showed little difference between the vortices of the two B757 series. Dr. Hallock also cochaired the session.
- Mr. Larry Berk of the Safety Information Systems Division presented the paper, "Predicting Near-Ground Vortex Lifetimes Using Weibull Density Functions," (AIAA-2007-1057) coauthored by Dr. James Hallock of the Safety Information Systems Division. The paper's technique could prove useful for defining aircraft separation standards. ■

Volpe Center Highlights

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the VOLPE center

The FRA administrator, Mr. Joseph H. Boardman, praised the awardees, saying, "their accomplishments represent some of the best of what we do."

FRA Recognizes Volpe Center's Contributions

The Volpe Center has provided research and development support to the Federal Railroad Administration for more than 35 years – and many of our staff members are regarded as staff extensions to the FRA. Several Volpe Center staff members were recently recognized for their outstanding achievements and their contributions to the FRA's mission, reflecting the relationship of respect and trust between the FRA and the Volpe Center.

Superior Achievement Award (Bronze Medal). Mr. Gary Baker of the Environmental Measurement and Modeling Division received a Superior Achievement Award (Bronze Medal) from the FRA's Office of Policy and Program Development. The Superior Achievement Award is the highest honorary award granted by the FRA Administrator and recognizes superior employee contributions of unusual value that help the FRA achieve its goals and objectives. Gary received the award for significantly advancing the FRA's Geographic Information Systems (GIS) capabilities and for providing exceptional mapping support to the FRA Administrator. Gary received the award for work he did while he was at FRA; he is now employed by the Volpe Center where he continues to provide innovative GIS support.

Mr. Gary Baker of the Environmental Measurement and Modeling Division received a Superior Achievement Award from the FRA's Office of Policy and Program Development.
(Photo by Bob Marville)

Team Awards. Two FRA teams, which included Volpe Center employees, received Team Awards from the FRA's Office of Safety. This award is given to teams for exceptional performance that results in the significant improvement, reinvention, or reengineering of practices or operations that contribute to the achievement of FRA goals and objectives.

- **Continuous Welded Rail (CWR) Joint Integrity Team,** composed of nine FRA employees and Volpe Center employees Mr. Jeff Gordon and Dr. David Jeong of the Structures and Dynamics Division, received a team award for outstanding teamwork, technical excellence, and application of collaborative skills in achieving recommendations for the development of a final rule on the integrity of joints in continuous welded rail.
- **Fatigue Management Team,** composed of four FRA employees and Volpe Center employee Dr. Stephen Popkin, Chief of the Human Factors Division, received a team award for exemplary development of creative, scientifically-based strategies to prevent and manage fatigue in the railroad industry. ■