Volpe
National
Transportation
Systems
Center

Volpe Center Highlights

Cambridge, Massachusetts July/August 2000

Director's Notes

Dr. Richard R. John

Supporting Safe Air Transportation

Welcome to this special edition of the Volpe Center Highlights focusing on our work for the Federal Aviation Administration (FAA). As we celebrate our 30th anniversary, it is appropriate to recall that the FAA has been a key customer of the Center since our inception and continues to be a major sponsor today. Together we work to ensure that when you fly in the United States, you are traveling on the safest, most efficient form of transportation available.

The Volpe Center's Office of Traffic and Operations Management performs a significant share of the FAA work. However, critical and important FAA programs are being conducted in every directorate office. While limited space here precludes a comprehensive listing of our FAA work, I do want to highlight some of the key programs we have worked on in the past as well as work that we are doing today for the FAA.

Strategic Systems Planning.
We are supporting a joint partnership between FAA and the National

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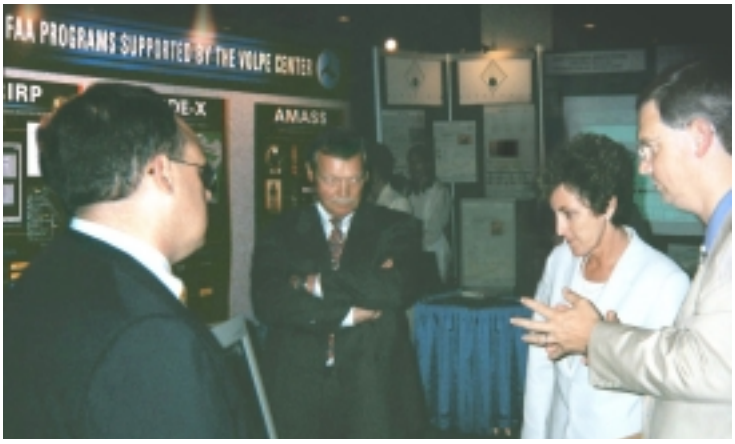
Focus

Technology Efforts to Reduce Runway Incursions Demonstrated at National Runway Safety Summit (FAA)

Increasing runway safety by reducing incidents and incursions is the Federal Aviation Administration's (FAA) "Number 1 Priority" and one of the National Traffic Safety Board's "Top 10" most wanted safety fixes, according to the FAA Administrator Jane Garvey. The FAA defines a runway incursion as: "Any occurrence at an airport involving an aircraft, vehicle, person, or object on the ground that creates a collision hazard or results in loss of separation with an aircraft taking off, intending to take off, landing, or intending to land."

Though relatively few in number when compared to the massive amount of traffic that moves safely through our nation's airports every day, runway incursions present a special problem. Not only do they have the potential to put more lives at risk due to the number and proximity of aircraft operating on the airport surface, they also take place in a complex and dynamic environment where root causes are difficult to isolate.



Mr. John LoBue and Mr. Dave Setser of the Volpe Center brief the FAA Administrator Jane Garvey at the National Runway Safety Summit. Also pictured: Mr. John Butler, a Volpe Center contractor (Cambridge Systematics, Inc.).

(Photo courtesy of Mr. John LoBue)

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RIRP

RUNWAY INCURSION REDUCTION PROGRAM

- The research and development goals of RIRP are to:
  - Provide seamless surveillance of the airport surface
  - Maintain and display vehicle identification and flight information
- System evaluation at Dallas/Fort Worth (DFW) is a continuation of the 1996 Atlanta/Hartsfield RIRP Demonstration
- The Volpe-developed Surveillance Server is the heart of the DFW System:
  - Fuses information from multiple sensors and subsystems
  - Provides a digitized visual representation of all aircraft and vehicles on the airport surface
  - Subsequently alerts controllers to potential runway incursions
- Provides Surveillance Server data to cockpit display during joint FAA/NASA RIPS demonstration

ASDE-X

AIRPORT SURFACE DETECTION EQUIPMENT (MODEL-X)

- The safety-critical ASDE-X system consists of a Radar Sensor, a Multilateration Sensor, a Multiprocessor, and high-resolution Displays
- The Multiprocessor subsystem combines independent surveillance data from the Radar subsystem with cooperative data from the Multilateration subsystem to provide the Air Traffic Controller with a single target displaying Flight ID
- The system will be capable of using all sensors at once, or using each sensor alone
- Future system enhancements could include safety alert logic and additional sensors
- The ASDE-X system is slated to go into more than 20 selected airports

AMASS

AIRPORT MOVEMENT AREA SAFETY SYSTEM

- AMASS is a safety logic enhancement to the ASDE-3, automatically providing conflict alerts to Air Traffic Controllers
- Both ASDE-3 and ASR radar data are used to introduce targets into the AMASS safety logic
- Several tools have been generated by the Volpe Center to aid in the optimization of AMASS;
  - The Analysis Tool depicts track records of aircraft and can be used to troubleshoot multipath problems
  - The Volpe Center has developed simulation capability to assess AMASS performance before installation using Flight Data Recorder information
- AMASS is scheduled to be installed in more than 30 of the nations busiest airports

In an effort to aid in the prevention and reduction of runway incursions, the FAA's Surface Integrated Products Team is working in conjunction with industry and other government agencies in researching and evaluating ways to increase the safety of aircraft and vehicle movement on the airport surface, and decrease the potential for accidents. The Volpe Center's Airport Surface Division provides technical and management support to the FAA in this effort.

From June 26 to 28, 2000, Mr. John LoBue, Mr. David Setser, Mr. Seamus McGovern, Mr. Francis Coyne, Mr. Joseph Ruggerio, and Mr. Brendan English of the Airport Surface Division participated in the National Runway Safety Summit held in Washington, D.C., and staffed an exhibition booth highlighting several FAA programs focused on mitigating runway incursions. These programs include the Airport Surface Detection System, model-X (ASDE-X); Airport Movement Safety System (AMASS); and the Runway Incursion Reduction Program (RIRP). Booth visitors included Administrator Garvey and Mr. Arthur Sullivan from the FAA's Runway Safety Program Office. Administrator Garvey and Mr. Sullivan were provided in-depth briefings by the Volpe Center.

While briefing Administrator Garvey, Mr. LoBue emphasized that the Volpe Center performed as an integral part of the FAA's team of civil servants and support contractors. He also discussed how Volpe Research and Development (R&D) efforts in the areas of data fusion and technical evaluations of lower cost surface surveillance radar systems leveraged the FAA's R&D efforts, providing the technical underpinnings for acquisition of the ASDE-X system. Mr. Setser then briefed the Administrator on the RIRP data fusion technology project currently in development/evaluation at Dallas/Forth Worth International Airport. The RIRP system fuses several operational and experimental surveillance sensors to provide seamless coverage of the airport surface, and also provides alerts of potential runway incursions between taxiing and landing/departing aircraft. Mr. Ruggiero then briefed Mr. Sullivan on recent improvements in the RIRP.

The National Runway Safety Summit was the culmination of a series of Runway Safety Regional Workshops held in various cities across the United States (Los Angeles, Seattle, Anchorage, Kansas City, Boston, Fort Worth, New York City, Chicago, Atlanta, Reno, and Washington, D.C.). The three-day Summit focused on recommendations, actions, and results of the regional workshops, a human factors symposium, and other industry-wide activities now underway to improve runway safety.

More than 500 aviation decision makers attended the Summit. Attendees included senior FAA management, aviation safety experts, and representatives of the airlines, pilot and air traffic controller unions, general aviation groups, and airports.

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

Supporting the Safe Flight 21 Program (FAA)

The Volpe Center is supporting the Federal Aviation Administration's (FAA) Integrated Product Team for Advanced Technology in their efforts related to the Safe Flight 21 Program (SF21), a three-year joint government/industry initiative to develop and demonstrate enhanced operational capabilities of free flight based on evolving communications, navigation, and surveillance technologies. The underlying core concept of SF21 is the sharing of real-time traffic and weather information between the pilot and the air traffic controller to provide enhanced operational capabilities.

The Capstone avionics suite has been installed in general aviation aircraft in Alaska to address safety problems. It includes GPS-based and ADS–B-based avionics and data link communications equipment.

(Photo courtesy of Mr. John Perkins)

An integral component of the SF21 Program is the Capstone Project, an accelerated effort to address safety problems associated with general aviation in Alaska. A recent National Transportation Safety Board study, "Aviation Safety in Alaska" (November 1995), found that bush pilots in Alaska have a fatal accident rate almost seven times greater than that of general aviation pilots in the "lower 48" states, making it one of the most dangerous jobs in the United States. By installing a Capstone avionics suite in aircraft—Global Positioning System (GPS)-based and Automatic Dependent Surveillance – Broadcast (ADS – B)-based avionics and data link communications equipment—the FAA hopes to greatly increase pilot situational awareness and to reduce the risk of midair collisions and controlled flight into terrain accidents in Alaska.

From June 10 to 16, 2000, Mr. John Perkins of the Technology and Knowledge Engineering Division and Mr. Robert Phillips of the Operations Assessment Division met with Mr. Leonard Kirk of the Aviation Technology Program at the University of Alaska at Anchorage. The University is currently under contract to the FAA to conduct pilot training and perform an empirical study to measure the safety benefits of the new avionics suite, which was installed in most commercial aircraft serving the Yukon-Kuskokwim Delta (YK Delta), a remote mountainous region in Alaska.

The YK Delta was chosen as a test site for the new avionics suite because the aircraft population serving this region is relatively self-contained and stable. Equipping aircraft in this area with the new avionics suite has improved the quality of life for residents in remote villages because the region is now more accessible to air traffic, and it is easier to evacuate medical emergency cases.

The Volpe Center is working with the University and the FAA SF21 staff in evaluating the safety benefits of the new avionics suite and in mitigating project risk.

Mr. John Perkins flew in a Cessna 185 float plane for an operational demonstration of the new avionics technology.

(Photo courtesy of Mr. John Perkins)

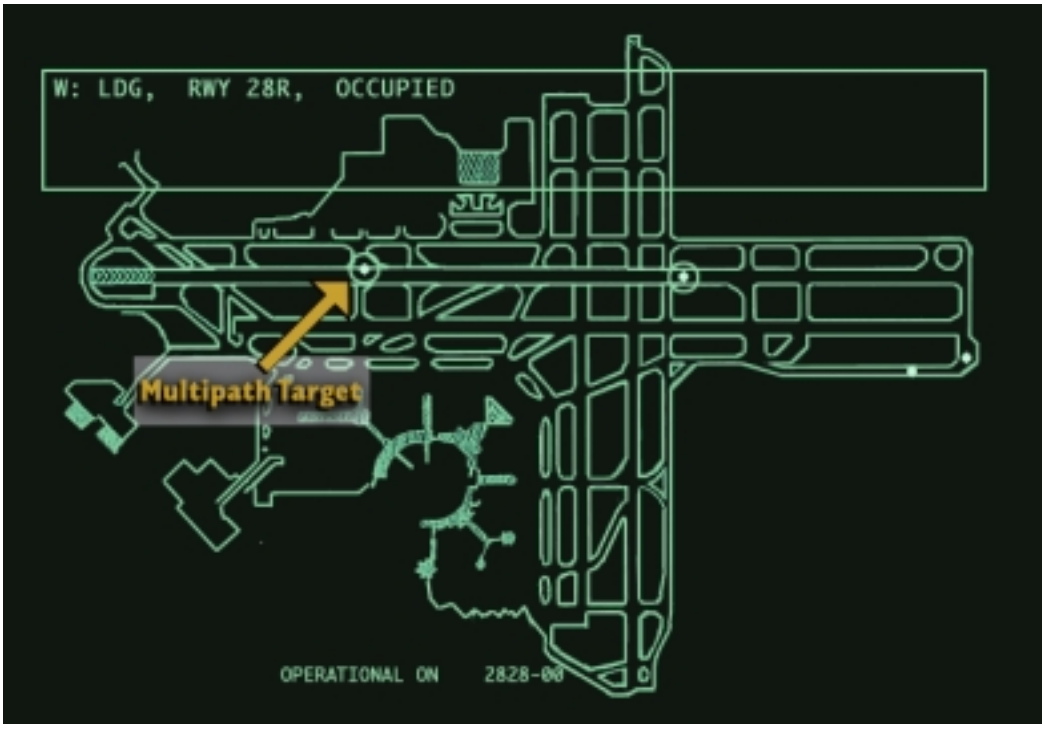
While in Alaska, Mr. Perkins and Mr. Phillips also met with Mr. Gary Childers and Mr. James Call of the FAA Alaska Capstone Project Office, and flew with Mr. Childers and Mr. Dean Hilde, a trained Capstone pilot, in Mr. Hilde's Cessna 185 float plane for an operational demonstration of the new avionics technology.

The Volpe Center also is supporting SF21 by providing program management/site coordination support at the Louisville Airport in Kentucky. From June 1 to 2, 2000, Mr. Steve Nuzzi of the Airport Surface Division briefed the SF21 Operational Coordination Group, which includes members of the FAA and aircraft industry, on the Phase 2 Operational Evaluation and the ground infrastructure status at the Louisville Airport. The briefing covered potential equipment locations and unresolved issues concerning ground station data links and local area networks.

Optimization of the Runway Safety System Reduces False Incursion Alerts (FAA)

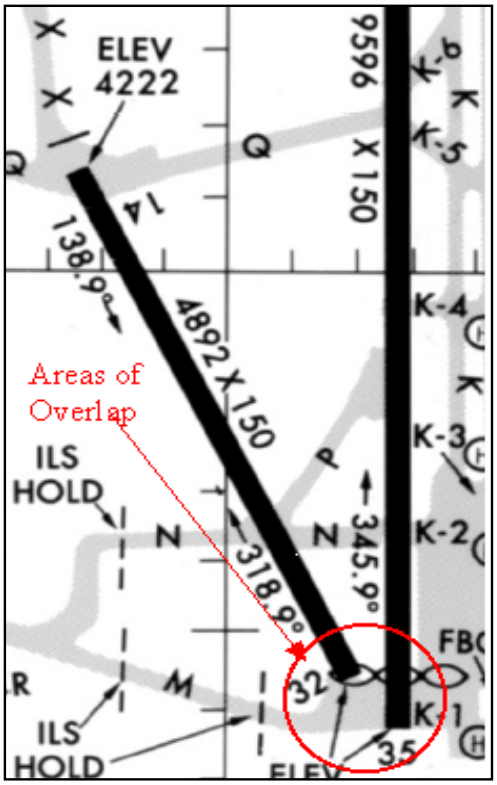
In support of the Federal Aviation Administration's (FAA) Integrated Product Team for Terminal Surveillance and Weather, the Volpe Center's Airport Surface Division is playing a key role in optimizing the Airport Movement Area Safety System (AMASS), a production air traffic control radar tool for reducing runway incursions. Volpe team members include Mr. Ian McWilliams, Mr. Jose Ortiz, Mr. Khang Nguyen, Mr. John Winkler, Mr. Brian Berkwitz, and Mr. Brendan English.

AMASS tracks targets such as aircraft on the runway from an ASDE-3 radar, usually placed on top of the air traffic control tower. AMASS tracks the targets and inputs data from those targets to "safety logic" algorithms to help controllers reduce runway incursions. As with any radar, multipaths (false radar reflections) are most always evident, especially in ground radar applications. The Airport Surface Division, working with the FAA, is trying to prevent multipaths from entering into the safety logic algorithms of the AMASS system, thereby preventing AMASS from issuing false alerts to air traffic controllers.



A view from the AMASS maintenance display unit at the San Francisco International Airport.

In addition to resolving multipath issues, the Volpe Center's Airport Surface Division's optimization effort consists of evaluating and analyzing individual airport operations to ensure that the maximum safety margins can be implemented using AMASS. Sites like Salt Lake City have straight in approaches making the parameter changes in AMASS simpler. In airports such as Boston, the circling approach warrants a review of more than 200 safety parameters. The Volpe Center team optimized 16 airport sites during fiscal year 2000. Currently, San Francisco is undergoing operational readiness testing and is expected to be fully operational in January 2001. Also, the team plans to visit another 16 sites in fiscal year 2001.



At the Salt Lake City Airport, depicted here, two runways share the same pavement. Sometimes, the prediction algorithms would tell AMASS that the aircraft was landing on runway 35 when, in fact, the aircraft was landing on runway 32. Therefore, an important aspect of optimization is to ensure that the safety parameters are adjusted properly so that aircraft are identified on the appropriate runways.

Volpe Plays Key Role in Helping FAA Secure Clean Audit (FAA)

During the early 1990s, DOT's Office of the Inspector General (OIG) cited several material weaknesses in the Federal Aviation Administration's (FAA) recording and accounting of National Airspace System (NAS) property assets. Given the extent of FAA assets, which are valued at approximately $25.5 billion, the OIG "disclaimer of opinion" was cause for concern. In an effort to address this situation, the FAA's Office of Financial Management asked the Volpe Center for assistance in strengthening the FAA's procedures and related systems for NAS property accounting.

Beginning in fiscal year 1996, the Volpe Center teamed with the FAA to analyze existing property accounting procedures, identify areas for improvement, and undertake a series of actions to implement those improvements. In particular, the Center completed a comprehensive analysis of the FAA's centralized acquisition process for NAS assets at FAA headquarters, and its regional procedures to complete and install these NAS assets at sites. The Center proposed and helped implement a series of recommendations to redesign these property and accounting procedures to record these assets in the financial and property records on an accurate and timely basis. The Volpe team designed new policies and procedures, identified systems modifications to support these changes, trained FAA personnel on the new procedures, and provided program management support to monitor the results of these changes.

As a result of these efforts, after seven years of disclaimers of opinion from the OIG, the FAA received its first ever "clean audit" of its financial statements in 1999. Speaking of this accomplishment, the FAA Administrator Jane Garvey remarked, "A clean audit brings the FAA to the standards of private industry for fiscal responsibility." She said it was a major financial turnaround for the agency and a gain in credibility.

In May 2000, the FAA recognized the contribution of the Volpe team to this success, presenting Mr. Steven Walkinshaw of the Technology and Knowledge Engineering Division with a memento from Administrator Garvey for the "FAA's First Unqualified Audit Opinion." The team consisted of federal staff, EG&G Technical Services, Inc. staff from the Operations Research Analysis and Engineering Services contract, and PricewaterhouseCooper's staff provided through the OMNI Information Systems Engineering contract.

Volpe Develops "Bulk" Ordering Process for FAA Telecommunications (FAA)

The Volpe Center's Telecommunications Division reached a significant milestone as part of the Federal Aviation Administration's (FAA) mandate to move its administrative phone services from the prior vendor, AT&T, to the new contract vendor, MCI Worldcom, by November 2000. The FAA would have been subject to significant financial penalties if this and other interim dates were not met.

Within two weeks after receiving a request from the FAA's Federal Telephone Service (FTS) Transition Program to develop a "bulk" ordering process, Volpe staff working on the Telecommunications Information Management System (TIMS) distributed spreadsheet data on approximately 13,500 existing circuits to the FAA's regional offices, Aeronautical Center, Hughes Technical Center, and headquarters for their use in transition ordering. TIMS was developed by the Volpe Center to support the management of FAA telecommunications assets through the use of a suite of desktop tools accessing an integrated database.

Development of the bulk ordering process involved designing an information system approach to allow spreadsheet files to be used as an order entry mechanism. This effort involved compiling the data in a predetermined spreadsheet form from the TIMS Oracle database, sorting and verifying data according to requested criteria, and creating user instructions and data dictionaries. This effort was completed to meet an extremely short schedule, considering the extensive coordination required from FTS program offices, regional offices, the service provider (MCI Worldcom), and the contracting office. Through September 2000, the Volpe Center implemented the approach to process more than 11,000 orders received from FAA offices. (The remaining existing circuits were not reordered.) Through the dedicated support of Volpe's FTS 2001 transition team, the Center helped the FAA meet its program objectives and its deadline well in advance.

Volpe Supports FAA Telecommunications Infrastructure (FAA)

In 1996, the Federal Aviation Administration's (FAA) Telecommunications Integrated Product Team initiated a new strategic planning activity to address the replacement of the FAA's leased and owned telecommunications assets between 2002 and 2006. The FAA Telecommunications Infrastructure (FTI), as the new activity is called, is a major multi-year program to meet the FAA's future operational and mission support communications requirements in an integrated, comprehensive, and cost-effective manner. The target implementation date of the program is 2001. The Volpe Center provides technical analyses, database development, and engineering support to the FTI Program.

At the request of the FTI Program Manager, the Volpe's Telecommunications Information Management System (TIMS) team produced a document to be included in the FTI Screening Information Request, which is used to select the contractor that will supply telecommunications services to FAA for the next 10 years. The 50-page document informs potential bidders of recommended interface requirements between the future selected vendor's business system and TIMS. The TIMS team also produced a second document that provides a preliminary cost estimate and schedule for making changes to the TIMS system related to developing FTI core business processes in TIMS, and to identifying developmental risks and mitigation approaches.

Ensure that the transportation system is accessible, integrated and efficient, and offers flexibility of choices.

Volpe Staff Member Appointed as President of the Institute of Navigation

During the month of June 2000, Ms. Karen Van Dyke of the Volpe Center's Center for Navigation was appointed as the President of the Institute of Navigation (ION). The ceremony took place during ION's annual meeting, which was held from June 26 to 29, 2000, in San Diego, California, as part of the International Association of the Institute of Navigation (IAIN) World Congress. Dr. Frank Tung, Deputy Director of the Volpe Center, and Dr. James Carroll and Mr. Jon Parmet of the Center for Navigation also attended.

Dr. Frank Tung congratulates Ms. Karen Van Dyke on her appointment as President of the Institute of Navigation.

(Graphic courtesy of Ms. Karen Van Dyke)

As President, Ms. Van Dyke will serve a 1-year term as Chief Executive Officer, as well as Chair of the ION Council and Executive Committee, which represents the ION at all official functions. Ms. Van Dyke previously served as the Eastern Region Vice-President, and more recently as Executive Vice-President. In this role, she chaired the Strategic Planning Committee.

While at the ION annual meeting, Ms. Van Dyke co-chaired a session on propagation and atmospheric effects, and attended ION Council meetings. Dr. Carroll moderated a Federal Radionavigation Plan user meeting. Mr. Parmet, who is working on the development of an outage reporting system for the Federal Aviation Administration's Wide Area Augmentation System, also participated in the IAIN/ION conference.

Advance America's economic growth and competitiveness domestically and internationally through efficient and flexible transportation.

Supporting the Surface Movement Advisor System (FAA)

The Surface Movement Advisor (SMA) is one of the key products of the Federal Aviation Administration's (FAA) Free Flight Phase 1 initiative to improve airspace utilization and reduce congestion. A collaborative effort between FAA and the airlines, SMA provides airlines at eight busy airports with estimates of arrival runway and touchdown times at 20-second intervals (Chicago, New York, Dallas/Fort Worth, Detroit, Philadelphia, St. Louis, Minneapolis, and Atlanta). SMA information is routed through the Volpe Center to the FAA and the airlines.

The Volpe Center's Traffic Management System (TMS) operations team now provides 24-hour, 7 day-a-week operational support for the SMA air traffic management information system. Each of the three operation shifts at the Volpe Center has received training and an SMA Troubleshooting Manual has been developed.

In addition, the Volpe Center is providing technical and planning support to the Free Flight Phase 1 Program Office in the preparation and approval of the SMA Security Certification and Authorization Package. From June 26 to 27, 2000, the Volpe Center met with representatives of the SMA Program Office, FAA's Office of Information Security, and the National Airspace System Policy Division to develop an information system security plan for the SMA. Specific Volpe Center input included details of the end-to-end SMA network, security devices, policies, procedures, and a vulnerability assessment.

Volpe Delivers Web-based Situation Display (FAA)

On June 5, 2000, the Volpe Center delivered Version 1.0 of the Web-based Situation Display (WSD) to the Federal Aviation Administration's (FAA) Air Traffic Control System Command Center in Herndon, Virginia. The WSD allows FAA sites to access the FAA's Enhanced Traffic Management System (ETMS), the real time, operational computer system developed by the Volpe Center that the FAA uses to predict, detect, and address airspace congestion problems. WSD will allow small terminal radar approach control facilities that are not ETMS remote sites to access ETMS data.

During the week of June 19, 2000, an upgrade to ETMS, Version 7.0, was installed at more than 80 FAA field sites. The new features included in Version 7.0 allow users to create new routes for traffic management during severe weather, and will allow airlines to send real-time schedule updates to ETMS and provide them with access to the Airport Demand List, which shows detailed flight arrival predictions at a given airport over the next 15 hours. Additionally, weather overlays now extend beyond the continental United States and include Canada and San Juan, Puerto Rico.

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

Supporting Helicopter Noise Study (FAA)

The Volpe Center is supporting the Federal Aviation Administration's (FAA) Office of Environment and Energy (AEE) in conducting a congressionally mandated helicopter noise study to evaluate the effects of non-military helicopter noise on people in densely populated areas and to develop recommendations for the reduction of these effects. This study is being conducted to meet the requirements of Section 747 of H.R. 1000, the Wendall H. Ford Aviation Investment and Reform Act for the 21st Century.

During the week of July 17, 2000, Mr. Gregg Fleming, Mr. Christopher Roof, Mr. David Senzig, Ms. Judith Rochat, and Ms. Cynthia Lee of the Volpe Center's Safety and Environmental Technology Division along with Mr. David Read, a Volpe Center contractor (W.T. Chen), and Mr. Sandy Liu of the FAA/AEE conducted field measurements of helicopter noise in Liberty State Park, New Jersey. Noise measurements also were taken at a downtown New York City heliport. These two data sets will be used in modeling analyses to examine flight track and operational alternatives that may help reduce helicopter noise in urban areas throughout the United States.

In support of the congressionally mandated study, the FAA held a public meeting in Washington, D.C., on August 16, 2000. The purpose of the meeting was to provide interested stakeholders (e.g., industry representatives and community groups) with an overview of the planned FAA study. Mr. Roof and Mr. Fleming attended the meeting and Mr. Roof provided an overview of the Volpe Center measurements. A second public meeting is scheduled for October 20, 2000, also in Washington, D.C.

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Aeronautics and Space Administration. Termed "Vision of the Transportation System After Next," this project's goal is to establish a vision and performance goals for transportation for 25 to 50 years into the future. This effort will consider possible future lifestyles and key trends (e.g., demographic, economic, political, and technological) and how these factors will drive mobility requirements, supply, and demand. From this information, we will then see how transportation might meet some of these requirements through a systems approach using key concepts and technologies.

Communications, Navigation, and Surveillance (CNS). We are applying our extensive CNS background and experience to develop new communication and surveillance systems and to improve existing ones; to analyze, design, and develop advanced surface surveillance systems and associated airport infrastructure; to develop and maintain systems that support the business functions related to telecommunications management and operations; and to provide telecommunications services ranging from strategic program planning to network design to field deployment. Our work on the Runway Incursion Reduction Program is receiving national visibility as we help the FAA address its current number one priority. Perhaps our most well-known activity for the FAA is our development and operation of the Traffic Management System, which is the operational system used by the FAA to predict, detect, and handle airspace congestion problems.

Aviation Safety. Aviation is a growth industry. Each year, more and more people are flying. New aircraft, both large and small, are being added to fleets around the world. Costs are also rising for labor and for fuel. In this dynamic environment, the FAA needs to remain vigilant to ensure that aviation safety is not compromised. Approximately 3,000 inspectors in the Flight Standards Service examine airlines, flight schools, training centers, repair stations, air personnel, designees, and aircraft to ensure their compliance with the regulations. We support the FAA Flight Standards Service by designing, building, implementing, and maintaining information systems that assist the aviation safety inspectors in their day-to-day activities. These systems record the results of inspector activity, changes in airline fleets, and work done by designees, and indicate when an entity such as an airline, aircraft type, repair station, or flight school is deviating from the norm, thereby warranting special attention.

Human Factors. Human error remains the most important contributing factor in aviation accidents and incidents, and we continue to increase the growing body of knowledge in this area, especially human factors affecting air traffic controllers. A key component in an air traffic controller's work is his/her display screen. Volpe researchers have conducted a study on the use of color in air traffic displays, and have developed guidelines for this area.

Physical and Information Security. We have contributed significantly to the physical and information security of critical national transportation systems including the National Airspace System. The Volpe Center has developed information security plans, policies, assessments, and remediation designs for many key systems such as a security plan for the Traffic Management System and a telecommunications security risk management plan.

Aircraft Noise Measurement, Modeling, and Analysis. Between 1982 and 1999, $4.3 billion was spent on noise-mitigation activities at U.S. airports. Our research in this area focuses on the design, development, maintenance, and documentation of the FAA's Integrated Noise Model, which is used for modeling noise in the vicinity of airports worldwide and for guiding noise-related decisions at U.S. airports. The Volpe staff is prepared to respond rapidly to aircraft noise issues that may arise throughout the country. We also have played a significant role in examining noise in our national parks resulting from increasing numbers of aviation operations in recent years.

Policy, Planning, and Economic Analysis. We have supported the FAA in conducting studies that have addressed a cross section of policy, planning, and economic topics. In the past, the Volpe Center has worked on the development of national airport capacity enhancement plans, led assessments of the economic and market potential of new air transportation services such as civil tilt rotor aircraft, examined the competitiveness of the domestic aircraft manufacturing industry and levels of competition and service within the domestic airline industry, and conducted planning reviews on landside and airport access and egress issues.

The Volpe Center is looking forward to its continued partnership with the FAA in efforts to enhance safety, improve security, and increase the efficiency of air travel throughout the 21st Century.

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Technology Efforts to Reduce Runway Incursions Demonstrated at National Runway Safety Summit.