

## **FLC NORTHEAST REGION NEWSLETTER – SUMMER 2009**

### **New Director Coming to AFRL Information Directorate in Rome**

Air Force officials announced recently that Dr. Davy M. Belk will succeed Dr. Donald Hanson as director of the Air Force Research Laboratory Information Directorate in Rome, N.Y. Dr. Belk, a member of the Senior Executive Service, is currently director, Engineering Directorate, Ogden Air Logistics Center, located at Hill Air Force Base, Utah.

Dr. Belk began his professional career in 1976 at the General Dynamics Fort Worth Division, participating in full-scale design and development of the F-16 Fighting Falcon as a maintainability engineer. In 1978, he began work at the Air Force Armament Laboratory at Eglin Air Force Base, Florida, serving there for nearly 16 years in a variety of research, technology development, system development and sustainment activities. He was later assigned to the Air Force Research Laboratory Munitions Directorate, where he developed computational fluid dynamics methods. Dr. Belk has also served at Headquarters Air Force Materiel Command as Technical Director for the Directorate of Engineering and Technical Management.

Dr. Belk received his B.S. in aerospace engineering from the University of Texas at Austin in 1976. He holds an M.S. in aerospace engineering from the University of Florida, as well as a Ph.D. in engineering from Mississippi State University.

In his new position, Dr. Belk will oversee the center responsible for leading the discovery, development, and integration of affordable warfighting information technologies for our air, space and cyber force. The Information Directorate's areas of investigation include a broad spectrum of information technologies for information fusion, information exploitation, information management, communications, command and control, advanced computing architectures, and cyber operations. The directorate reports to the Air Force Research Laboratory at Wright-Patterson Air Force Base, Ohio.

Dr. Hanson, also a member of the Senior Executive Service, plans to retire from federal service in June.

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### Compact Cancer Therapy Particle Delivery System Patented

As part of an effort to make high-precision particle cancer therapy accessible to more patients, a physicist at Brookhaven National Laboratory has developed a simpler, less-expensive gantry design for delivering tumor-killing particle beams. Brookhaven Science Associates, the company that manages the Lab for the Department of Energy (DOE), has applied for a U.S. nonprovisional patent on the design, which is now available for licensing and commercial development.

“This design uses smaller magnets to steer and focus the beams, which greatly reduces the cost, weight, and size of the particle-delivery system and simplifies its operation,” said inventor Dejan Trbojevic, an accelerator physicist at Brookhaven Lab. “Since the beam-delivery system is the most expensive piece of equipment at a particle cancer-therapy facility, this new design could make such facilities more economical to build and operate, thus making particle therapy accessible to more cancer patients around the world.”

Unlike conventional radiation beams, which deposit energy as they travel through healthy tissue on the way to internal tumors, particle beams made of protons or charged ions, such as carbon, deposit most of their energy at the cancerous tumor. Thus, precisely aimed particle beams have more cancer-killing potential in fewer doses, and with less damage to healthy tissues, than conventional radiation.

But particle cancer-therapy facilities are expensive to build, in large part due to the size and complexity of the beam-delivery systems. One challenge is that the particle dose has to be delivered to patients from various positions, and with very good reliability and stability, with the whole device rotating around the patient while staying focused on the tumor. In such a machine, size and weight matter.

Recent advances in particle accelerator design have resulted in the use of smaller and less complex magnets. Trbojevic, who has worked on accelerator developments for basic physics research at Brookhaven Lab for 17 years, incorporated these developments into the new medical gantry design. “The opportunity to be involved in accelerator physics development for projects like the Relativistic Heavy Ion Collider (RHIC) has enabled me to further expand my knowledge for medical applications,” he said.

Trbojevic’s design makes use of fixed-field magnets, as opposed to the much larger and more complex variable magnets used at most existing particle-therapy facilities. Depending on the type of beam the facility is designed to deliver, these magnets may be superconducting or permanent magnets. In this design, the beam is transferred for the whole energy range without the need for any changes in the magnets. Additionally, each of the magnets performs two functions: bending the particle beam along the particle path, and either focusing or defocusing the beam for precision particle delivery.

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“Protons or carbon ions with a wide range of energies can be transported precisely through the small combined-function magnets,” Trbojevic said. “These magnets provide extremely strong focusing and control of the beam positions.

“Because these magnets are so compact, the weight of the entire gantry can be about 100 times less than it would be with the variable magnet design,” he said. As an example, a 160-ton gantry made from conventional magnets would weigh about 1 1/2 tons using Trbojevic’s design. Even with equipment needed to keep the superconducting magnets cool, the particle delivery system would still be more compact and economical than existing designs.

The very small, combined-function, superconducting magnets that make the new design so attractive could be manufactured at Brookhaven Lab, Trbojevic suggested, adding that a preliminary design already exists.

### **Commercial Fishermen, NEFSC Scientists Collaborate to Learn More about Monkfish**

National Oceanic and Atmospheric Administration (NOAA) scientists and fishermen are working together aboard commercial fishing vessels to gain information about the monkfish population in northeast U.S. waters, part of an ongoing collaboration between the Northeast Fisheries Science Center (NEFSC) of NOAA’s Fisheries Service and the monkfish industry under the center’s Cooperative Research Program.

John Hoey, who directs the program, and NEFSC colleagues Rob Johnston and Anne Richards have worked with the monkfish industry for the past several years to develop the 2009 survey, which is funded with approximately \$1 million from NOAA. Cooperative monkfish surveys were also conducted in 2001 and 2004. “The monkfish industry wanted to do another survey as part of ongoing efforts to improve stock assessments, and to compare results from these industry-based surveys with those from the new NEFSC survey vessel *Henry B. Bigelow*,” Hoey said. “We have worked closely with the fishermen from the beginning, and midway through the sampling cruises things are going very well.”

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The 2009 surveys began in February and were completed in April. The sampling efforts will provide information about the size, age and sex composition of monkfish, officially known as goosefish (*Lophius americanus*), as well as their geographic distribution. Two fishing vessels, the 100-foot *Mary K* and the 119-foot *Endurance*, both based in New Bedford, Massachusetts, sampled at more than 200 locations in U.S. waters, from Cape Hatteras to the Gulf of Maine. Five fisheries scientists were aboard each vessel working with the vessel's crew. *Endurance* worked in the Gulf of Maine and the northern Georges Bank region, and the *Mary K* worked in southern Georges Bank, southern New England, and the Mid-Atlantic region as far south as Cape Hatteras, North Carolina. The F/V *Mary K* was also involved in the 2001 and 2004 surveys. The F/V *Drake* from Portland, Maine, also participated in 2001.

Scientists tagged fish for recapture studies, and conducted studies of monkfish reproductive biology, genetics, diet, and their distribution with respect to water temperature. Estimates of monkfish population size will be made from data collected in the diverse geographic areas sampled in U.S. waters ranging in depths from 15 to 250 fathoms (90 to 1,500 feet).

Johnston, chief survey scientist in Cooperative Research, said the scientists and fishermen also conducted experimental work to estimate the efficiency of each net used in the survey, and compared the catch rates in commercial monkfish nets with those used in NEFSC standardized bottom trawls, which collect samples of many species for stock assessments required under federal fishery management laws.

“This survey allows us not only to develop another estimate of monkfish biomass, the total weight of the monkfish population, but will improve our estimates of vital characteristics such as age, growth and maturity,” said Richards, the primary assessment scientist for monkfish.

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### **NAES Lakehurst Recognized for Environmental Protection Efforts**

In conjunction with Earth Day, the Environmental Protection Agency (EPA) presented an Environmental Quality Award to the Naval Air Engineering Station (NAES) in Lakehurst. NAES Lakehurst was one of seven winners from New Jersey honored for efforts to protect the environment. EPA Acting Regional Administrator George Pavlou presented the awards in April at a ceremony at the EPA's office in Manhattan, and environmental advocate Majora Carter delivered keynote remarks. "These exemplary environmental stewards have gone above and beyond for environmental change in local communities around New Jersey," said Pavlou. "Let their extraordinary contributions remind us all that we can make our world a better place and individuals really inspire others and make a lasting difference."

NAES Lakehurst was recognized for its environmental management system, which is used as its primary means to achieve environmental compliance and improve environmental quality. In 2008 the station achieved a total solid waste diversion rate of 94 percent, as well as reduced hazardous waste generation by 27 percent and nitrogen oxide (NOx) emissions by 33 percent. In addition, NAES Lakehurst has preserved over 400 acres adjacent to the station, providing a future environment that includes open lands, species habitat, and resource stewardship.

The EPA selects Environmental Quality Award winners from nonprofit environmental and community groups, individual citizens, educators, business organizations and members of the news media, as well as from federal, state, local or tribal governments and agencies. The honor is given to those individuals or organizations that have made significant contributions to improving the environment and public health in EPA Region 2, which covers New Jersey, New York, Puerto Rico, the U.S. Virgin Islands, and seven federally recognized Indian Nations. Nominations for the awards are received from both inside and outside the EPA.

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### **Volpe Center Evaluates State-of-the-Art Vehicle Safety Systems**

The Volpe Transportation Systems Center serves as the independent evaluator of the Integrated Vehicle-based Safety Systems (IVBSS) project, the first large-scale initiative for both light vehicle and heavy truck platforms focused on safety system integration. IVBSS technologies warn drivers in crash-imminent situations, helping to prevent rear-end, lane-change, and road-departure crashes.

IVBSS is a cooperative effort by an industry team led by the University of Michigan Transportation Research Institute and the Department of Transportation (DOT). The team includes the National Highway Traffic Safety Administration (NHTSA), the Federal Motor Carrier Safety Administration (FMCSA), and the Research and Innovative Technology Administration Intelligent Transportation Systems Joint Program Office (RITA JPO).

The IVBSS research initiative seeks to accelerate the introduction and commercialization of integrated vehicle-based crash warning systems for light vehicles and heavy trucks. The objective is to assess potential safety benefits and driver acceptance of the integrated safety systems. These integrated systems are expected to prevent conflicting warnings, reduce false alarms, enhance consumer and fleet operator acceptance, and boost product marketability.

The Volpe Center team worked closely with DOT and industry team members, and provided expert input to the IVBSS program, including:

- IVBSS system design and functionality
- Verification of test procedures for track and public road tests for cars and trucks
- Test-track and public road verification testing of prototype IVBSS on both cars and trucks
- Evaluation of verification test results
- Recommended system performance enhancements prior to the field trials.

Based on test results, the project will proceed with large field operational tests (FOTs) of IVBSS-equipped light vehicles and heavy trucks this year. The Volpe Center team prepared an independent evaluation plan for IVBSS based on data to be collected in the FOTs, developed data mining algorithms, and devised analytical techniques to forecast the safety benefits likely to accrue from widespread national IVBSS deployment.

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### **Picatunny Employees Receive Army Research and Development Achievement Awards**

Thirty-three Armament Research, Development and Engineering Center (ARDEC) employees received 2008 Army Research and Development Achievement (RDA) awards on April 16. Col. Russell J. Hrды, ARDEC deputy director, distributed the awards, presenting each winner with an official plaque.

The RDA award is the Army's top award for research and development. In all, the Army recognized 39 projects, 8 of which were designed by ARDEC employees. That means that 20 percent of the total projects recognized were from ARDEC.

"Twenty percent—that's really a testament to the innovation and skill of our workforce to pull in that many awards. And that's really a credit to what you do, and I congratulate you on that," Hrды told the recipients. The awards span the gamut of current and future-force work, he explained.

Those recognized include:

- Matthew Evangelisti, Vincent Gonsalves, Keith Fulton and Gerrard Eilert for their work on the RKG-3 grenade simulator, a training item for soldiers that simulates the functioning of RKG anti-tank grenades used by insurgents.
- Sanjeev Singh, Philip Samuels, Paul Vinh and Chandrark Patel for their work on the development of the first Army explosive formulation to pass all insensitive munitions tests. Because of its low cost and acceptable energy output to destroy enemy targets, the IMX-102 was developed to replace the widely used explosive TNT.
- Douglas Troast, Dr. Donald Carlucci, Alan Totten, James Hahn, and Thomas Coradeschi for their work on the XM982 Excalibur precision-guided extended-range artillery projectile.
- Dr. Andrew Littlefield, Edward Hyland, Daniel Crayon, and Upendra Patel for their work on the high-tension wrapping of thermoplastic composite structures, a multi-year effort that culminated in 2007 with the wrapping of the second of two prove-out tubes as part of the Durable Gun Barrels Manufacturing Technology Program. With the successful completion of this tube, the technology was transitioned to the Army's Electromagnetic Railgun Program and the 120 mm XM360 System Design and Development Program.
- Stephen Chico, John Costello, Khaled Darwish, Josiah Fay and Christopher McEwan for their work on the Abrams Reactive Armor Tile System for enhanced protection to the Abrams tank.

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- Daniel Cler, Robert Carson, Jeffrey Greer and Mark Doxbeck for their work in enabling technologies for muzzle-brake development designs that will enhance overall system mobility and lethality through system weight reduction and parallel-guided munitions development compatibility.
- Deepak Bupathi and Ross Towers for their work on the Picatinny Optical Detection System, known as PODS, which allows soldiers to remotely observe hostile combatants, to include snipers, forward observers and triggermen. PODS is an optical-augmentation system designed specifically to detect the optics used in remote observation relying on retro-reflection technology, thereby enabling the warfighter to locate and situate potential optical threats prior to engagement.

King Siu, Brian Peltzer, Mark Mellini, Amir Morcos and Myron Hohil for their work on Rattlesnake, an unattended ground-sensor system to address and defeat improvised explosive device threats.

### 2009 Northeast Region Awards – Call for Nominations

The Northeast Region is now accepting nominations for its 2009 awards. Nomination forms are available at <http://www.flcnortheast.org/awards.html>. The deadline to submit nominations is Tuesday, June 30, 2009, and the awards will be presented in September 2009 at the Northeast regional meeting in Princeton, New Jersey.

Awards will be presented in the following categories:

- ***Regional Coordinator's Excellence Award***  
Presented to the FLC Laboratory Representative or Alternate in recognition of the individual's significant contribution to the FLC program during the past year. The individual selected for this award will be the Northeast Region's nominee for the national FLC Representative of the Year Award.
- ***Regional Laboratory Award***  
Presented to the federal laboratory within the Region in recognition of extraordinary efforts, which exceed legislated requirements, in the furtherance of national and regional technology transfer activities.

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- ***Regional Appreciation Award***  
Presented to any individual who is not a direct employee of a government-owned and government-operated (GOGO) or a government-owned, contractor-operated (GOCO) organization who has made a significant contribution to the federal technology transfer program. The act, effort, or support must have been for the primary purpose of promoting and/or extending technology transfer from the federal laboratory system to non-federal entities. The individual selected for this award will be the Northeast Region's nominee for the national FLC's Outstanding Service Award.
- ***Industry/Non-Federal Government/University Award***  
This award is presented to an American-owned company, a non-federal government entity, or university within each FLC region that has made outstanding efforts to promote either the actual transfer of federal technology transfer or the federal technology transfer program during the 12 months preceding the nomination.
- ***Excellence in Technology Transfer Award***  
Presented to laboratory employee(s) who have accomplished outstanding work in the process of transferring federally developed technology to the marketplace. The winners of this award will be nominated for the national FLC Award for Excellence in Technology Transfer.

### **CT Scan to Help Scientists Diagnose Role of Clouds in Climate**

During May and June, scientists from Brookhaven National Laboratory, Argonne National Laboratory, and the University of Colorado at Boulder will use high-tech scanners—analogueous to those used in medical settings—to make observations of clouds. The research, conducted at the Department of Energy's (DOE) Atmospheric Radiation Measurement (ARM) Climate Research Facility (ACRF) in Ponca City, Oklahoma, could lead to more accurate weather forecasts and predictions about climate.

“Clouds play a critical role in Earth's weather and climate,” said Brookhaven atmospheric scientist Dong Huang, lead researcher for this study. “But poor understanding of clouds has long limited scientists' ability to make accurate predictions about weather and climate change.”

One major challenge is the sheer scale of the problem. Cloud processes occur on spatial scales ranging from sub-micrometers (millionths of a meter) to thousands of kilometers. The typical probes used by scientists sample a tiny volume. “Using these methods, it would take hundreds of years to take readings from an entire cloud, while the typical lifetime of a cloud is just tens of minutes,” said ARM chief scientist Warren Wiscombe, a co-investigator on this study.

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To scan a larger area in a short time, the team will use a novel “cloud tomography” approach to reconstruct a three-dimensional cloud structure. “Our approach is very similar to the x-ray computed tomography (CT) used by doctors to diagnose disease, but this time the patients are clouds,” said Huang. A CT scanner obtains x-ray data of the body “slice by slice” using detectors that rotate around the patient. Similarly, a cloud tomography system uses multiple microwave sensors to scan clouds from several distinct ground locations. The interior structure of a cloud can then be inferred from the resultant radiometric measurements using sophisticated algorithms.

The scientists will use a network of five microwave sensors to probe clouds’ thermal emission, or release of heat energy, along with two cloud radars, a variety of optical and infrared sensors, and weather balloons to measure other characteristics. “Using this combination of instrumentation, we will be able to obtain three-dimensional ‘maps’ of the distribution of clouds, atmospheric moisture, and other characteristics over a domain of about 10 kilometers,” said Huang.

The quality of the cloud and moisture reconstructions will be evaluated using concurrent cloud measurements collected by a research aircraft operated by another field experiment led by Brookhaven atmospheric scientist Andy Vogelmann. This study will collect long-term statistics on low optical-depth clouds.

The combined data will enable scientists to better understand the role of clouds in regulating Earth’s “radiation energy” budget—or how the planet absorbs and re-radiates energy from the sun. These data will also be used to assess the validity of how various cloud processes are represented in computer models of cloud behavior.

“The combination of intensive field experiments, long-term observations, and modeling will provide important insights that could directly benefit weather forecasting and climate modeling,” Huang said.

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### Lakehurst Engineers and Artisans Provide Support to Newest Navy Carrier

In January, Tom Gerace, a recovery systems lead engineer at Naval Air Systems Command (NAVAIR) Lakehurst, was challenged with the task of refurbishing an old barricade power pack to be used on the newest aircraft carrier, the *USS George H.W. Bush* (CVN-77). The barricade power pack is a piece of equipment that provides and maintains the fluid pressure required by the hydraulic cylinders that raise and lower the barricade stanchions on the flight deck. The stanchions are the two large support structures that hold up the barricade webbing assembly (a nylon web system) needed to absorb the kinetic energy of a landing aircraft and transmit it to the arresting gear engine.

When faced with engineering design difficulties and time constraints for a new electro-mechanical actuator system, the Navy turned to Lakehurst engineering and manufacturing experts to refurbish an old hydraulic power pack from the decommissioned carrier *USS Constellation* (CVN-64). That's when Gerace and his team got the call.

With a due-to-the-fleet date of March 31, the Lakehurst crew went to work reconstructing and refinishing the old power pack. As a result of the efforts and expertise of 41 different artisans, 1300 man hours and a cost of approximately \$250,000, the project was completed on March 16, two weeks ahead of schedule and within budget constraints. Knowing how vital this equipment is to enable aircraft to successfully land on carriers, the Lakehurst team stayed focused and committed to the task until the job was done and the power pack could be delivered to CVN-77 for installation. The "can do" attitude of the dedicated employees at Lakehurst is indicative of the service and support that NAVAIR provides to the fleet each and every day.

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### Turtle Travels: From Woods Hole to Jekyll Island, Georgia

Dory, Boo Boo and Godzilla are not typical names for patients being treated for pneumonia and exposure to cold water, but these three are not typical patients. They are endangered sea turtles, and after spending months at the Woods Hole Science Aquarium recovering after being stranded on Cape Cod beaches over the past two winters, they are heading south to be released in the warm waters off Jekyll Island, Georgia.

“Most turtles head south before the weather turns cool in the fall, but almost every year some stragglers are ‘cold-stunned’ or hypothermic when the water temperatures fall in late October and November, and they drift ashore on Cape beaches,” said Rachel Metz-Leland, senior aquarist at the Woods Hole Science Aquarium, part of the National Oceanic and Atmospheric Administration’s (NOAA) Northeast Fisheries Science Center’s (NEFSC) laboratory in Woods Hole, Massachusetts. “They will die if they don’t receive proper care to get them back into good health.”

Boo Boo, a juvenile Kemp’s Ridley (*Lepidochelys kempii*) turtle, was found stranded at North Ryder Beach in Truro, Massachusetts on November 28, 2007. Dory, also a juvenile Kemp’s Ridley, was found a few days later on December 1 at Great Island Gut in Truro. Godzilla, a sub-adult loggerhead (*Caretta caretta*), was found on November 29, 2008, at North Ryder Beach. The three turtles have spent the months since then recovering out of the public eye at the Aquarium, which helps rehabilitate sea turtles as space permits. The facility is also home to two nonreleasable harbor seals, LuSeal and Bumper.

“The turtles’ names, based on cartoon characters, were chosen by the New England Aquarium, which coordinates the sea turtle stranding and rehabilitation effort,” Metz-Leland said. “They pick themes each year. Last year it was herbs and spices, so we had turtles here named Lavender and Cumin.”

The Woods Hole Science Aquarium has been rehabilitating sea turtles since the 1990s and has helped care for 31 turtles to date: 16 Kemp’s Ridley, 3 green, 5 loggerheads and 7 diamondback terrapins. The turtles receive regular veterinary care, and get much of their day-to-day care from the Aquarium staff and volunteers.

Boo Boo, Dory and Godzilla were packed into specially built crates April 28 for the trip by vehicle to the Georgia Sea Turtle Center on Jekyll Island, Georgia, where they will be released offshore along with rehabilitated turtles from other New England facilities. Turtles are usually released in local Cape waters in July or August, but the water is too cold and the animals are ready to get back to the wild now.

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When sea turtles are first found on the beach, they are sent to the New England Aquarium in Boston, which acts much like a hospital triage center. Their injuries and condition are determined, and they are slowly warmed and treated for pneumonia or any complications from stranding. Once they are stable and to free up hospital space, the New England Aquarium sends them to smaller facilities like the Woods Hole Science Aquarium to continue rehabilitation until they have regained full health and are ready to be released to the wild.

Metz-Leland said four species of sea turtles can typically be found in New England waters: green, Kemp's Ridley, leatherback, and loggerhead. Diamondback terrapins, a coastal turtle rather than a marine one and considered threatened under Massachusetts law, is found in marshes and estuaries.

The smallest of the sea turtle species, Kemp's Ridelys, are found in the north Atlantic from Florida to New England and in the Gulf of Mexico. Loggerhead turtles, found in temperate and tropical regions around the world and the most abundant sea turtle species in the U.S, range from Maine to Florida on the Atlantic coast.

### **Volpe Center Crashworthiness Experts On-call**

The Volpe Transportation System Center's Rail Equipment Crashworthiness Team conducts research to generate technical information that can serve as the basis for federal regulations, industry standards, and railroad specifications. This information relates to passenger- and freight-equipment crashworthiness and occupant-protection features. The team's activities include investigations of train accidents; development of improved crashworthiness strategies; impact tests of baseline and improved-design equipment; and analyses of car-crush, and train and occupant dynamics.

Beginning in 1999, the team has been on-call to investigate severe passenger train collisions. To date they have investigated 14 accidents. Recent investigations include the following collisions:

- A Metrolink commuter train and a Union Pacific freight train near Chatsworth, California, September 12, 2008
- Two Massachusetts Bay Transportation Authority (MBTA) Green Line trains in Newton, Massachusetts, May 28, 2008
- A freight car and an MBTA commuter train in Canton, Massachusetts, March 25, 2008
- An Amtrak passenger train and a freight train in Chicago, Illinois, November 30, 2007.

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An important component of these investigations is determining the sequence of events leading up to the accident, including reconstruction of train motion and occupant kinematics.

The Volpe Center team is currently working with the Federal Railroad Administration to develop standards for crashworthy light rail-style equipment for mixed-use service with conventional passenger and freight equipment.