SPARKING INNOVATIVE TRANSPORTATION SOLUTIONS

Issue 7
Fall 2004

Ignition

News from **TRB's IDEA** Programs

HIGH-SPEED RAIL
HIGHWAY SYSTEMS
TRANSIT &
TRANSPORTATION SAFETY

INSIDE:

- Securing Transportation Systems
- Detecting Dangers

TRB
TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

Sparking Innovative Transportation Solutions

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Safety

THE IDEA PROGRAMS

Innovations Deserving Exploratory Analysis

IDEA programs provide start-up funding for promising but unproven innovations in surface transportation systems. The programs' goal is to foster ingenious solutions that are unlikely to be funded through traditional programs.

Managed by the Transportation Research Board, IDEA programs are supported by the member state departments of transportation of the American Association of State Highway and Transportation Officials (AASHTO), the Federal Transit Administration (FTA), the Federal Railroad Administration (FRA), and the Federal Motor Carrier Safety Administration (FMCSA).

The Transit IDEA program, which receives funding from FTA as part of the Transit Cooperative Research Program, is guided by a panel chaired by Fred Gilliam, President/CEO, Capital Metropolitan Transportation Authority in Austin, Texas. Harvey Berlin is the TRB program officer.

High-Speed Rail IDEA is funded by the FRA as part of its next-generation high-speed rail research. A committee chaired by Mike Franke, National Railroad Passenger Corporation, has oversight. Charles Taylor is the TRB program officer.

The NCHRP Highway IDEA program is supported by the member state departments of transportation of AASHTO through the National Cooperative Highway Research Program (NCHRP). It is guided by a panel chaired by Richard Stewart, South Carolina DOT (retired); Inam Jawed is TRB program officer.

Safety IDEA is jointly funded by FMCSA and FRA. The committee is chaired by Ray Pethtel, Virginia Tech Transportation Institute. Harvey Berlin is TRB program officer.

Visit the IDEA web site:
www.trb.org/idea

Cover photo by Jim Steinhart, www.planetware.com.

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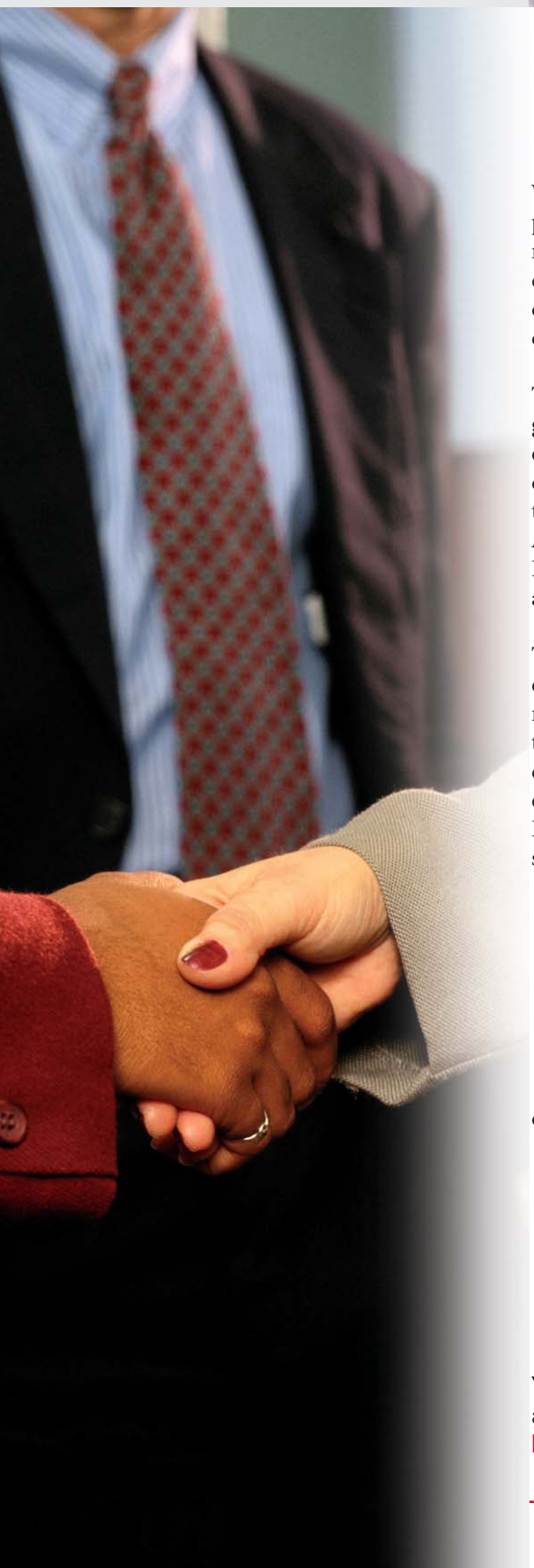

Contributing Factors

When asked how to improve a proposal's chances for selection and funding by an IDEA program, wise advisors nearly always reply that working with a transportation agency that might use the potential product has great advantages. It is best to meet up with practical constraints on an innovative concept early in its development and often the best place to do that is in the rail yard or pavement lab or subway station where the innovation would do its job.

Transportation agencies that participate in developing and testing IDEA projects make a great contribution to this process. Their collaboration facilitates advances in practice not only through on-site testing, but also by using the opportunity to inform the product design and development to meet the real needs of transportation agencies across the country. The Washington Metropolitan Area Transit Authority, the New York City Transit Authority, and the Port Authority of Allegheny County are each participating in a Transit IDEA project reported on in this issue, as others have done previously. Their contributions are appreciated.

Those transit projects are all related to boosting transportation security, reflecting the focus of this issue. A December 2001 report of The National Academies discussed the types of research that are needed to counter terrorism. Their recommendations related to surface transportation are described in the Insight section, page 4. The New Ideas department describes a variety of sensor systems to detect chemical, biological, and radioactive hazards on pages 6 and 7. In the Business section we break with the security theme to celebrate an IDEA 'graduate' that is now an entire product line, proving what every innovator learns sooner or later—perseverance pays off.

Linda Mason
Communications Officer
Transportation Research Board
of the National Academies

[Readers may remember this column's title as From the Director's Desk. The director has decided it's time for the editor to take credit for her own mistakes, hence the name change.]

Your comments are welcome
and may be sent to the editor at:
lmason@nas.edu.

Deter, Detect, Respond, Recover

The Role of Research in Transportation Security

Transportation is vital to the nation's economic productivity and mobility. Its efficiency and accessibility are unmatched in the world, moving millions of people and tons of products daily. These characteristics also make transportation systems attractive targets for terrorist acts.

While much attention has been focused on security in the aviation sector since September 11, 2001, many of the methods and technologies developed to secure that sector do not translate well to the surface transportation environment. In *Protecting Public Surface Transportation Against Terrorism and Serious Crime,* author Brian Jenkins explains: "Passenger profiling, passenger screening, and the elaborate deployments of metal detectors, X-ray machines, explosives sniffers, hand searchers, and armed guards that have become features of the passenger landscape at airports cannot be transferred easily to subway stations, bus stops, or light rail platforms.... The delays would be enormous and the costs prohibitive. Surface transportation lines, like power lines and pipelines, are extremely difficult to protect." [Jenkins 2001, p.1]

In December of 2001, the National Academies convened the Committee on Science and Technology for Countering Terrorism to help the federal government develop an integrated science and technology plan and research strategy for combating terrorism.

Making the Nation Safer, the committee's report, includes a discussion of the types of research that would support development and deployment of security systems within transportation.

Sponsors of the IDEA programs have anticipated or responded to the recommended areas of investigation by including them in high-priority focus areas for IDEA proposals. Research needs identified in the report related to surface transportation are described here to encourage IDEA proposals in these areas. Four projects that are developing innovative methods to enhance transit security have already been funded by the Transit IDEA program and are underway. The High-Speed Rail, NCHRP Highway, and Safety IDEA programs are also looking for projects to enhance security for rails, highways, and trucks.

"Making transportation safer is a principle part of making the nation safer."

Transportation systems are by necessity open, diverse, and spread out, and for these reasons, each as a potential target cannot be defended individually. These characteristics suggest a need for a coherent and systematic approach to security that includes the elements described in the following sections.

LAYERED AND DUAL-USE SECURITY SYSTEMS

Security systems made up of interleaved layers of monitors, sensors, trackers, and detectors that support—not inhibit—transportation operations will best facilitate safe and efficient transport of people and goods and are most likely to be adopted by budget-constrained transportation providers. Technologies that mesh security with dispatching and tracking vehicles and monitoring the condition of infrastructure such as track, tunnels, and bridges can boost the performance of the system as a whole. Such layered security systems in which multiple features are connected and provide backup for one another cannot be breached by defeating a single layer and they are more likely to be accepted and maintained by transportation providers because they confer benefits.

DETER AND DETECT

Deterrents to hostile acts, such as good lighting, reliable communications and surveillance systems, and well-trained guards and personnel are the first line of defense. Actions taken by local traffic control centers to prevent commuter and subway trains from passing under the World Trade Center after the first tower was hit may have saved hundreds of lives and show how essential vigilant, real-time monitoring is. A current transit IDEA project investigating the use of wireless networks as a means of real-time video surveillance is described on page 7.

Container and baggage inspection technologies, explosives detection, and real-time sensors to detect and identify a wide variety of chemical and biological agents are other needed detection techniques. An array of detector technologies will be necessary to crosscheck the validity of others and, to the extent possible, avoid false alarms. (See pages 6 and 7 for descriptions of current Transit IDEA projects investigating biological, chemical, and radiation detection methods for subway systems.)

PROTECT AND MITIGATE

Research on architectural features, materials, and construction methods to harden transportation facilities could find better ways to mitigate the effects of blasts in stations and in containers hauled by trucks and trains.

Specialized research on containing the release of chemical and biological agents within transportation environments is needed; for example, understanding how trains moving in subway tunnels may push contaminants within the underground system and through vents into the streets above. This work would also inform development of ventilation barriers and filters, as well as emergency response plans.

RESPOND AND RECOVER

Response to an event relies on communications paths, equipment, and protocols. Ways to enhance decisionmaking and communications capabilities among responders and transportation agencies are needed. Means to safely reroute traffic around the disrupted areas and regional response plans that coordinate highway and public transportation systems would help save lives of those who can then avoid the affected areas and of those who emergency responders could reach more quickly.

The ability to quickly recover from an event and reconstitute transportation services is crucial to limiting the cascading effect of terrorist attacks. Neutralizing agents for hazardous chemicals and infectious substances, robots that can survey affected areas and perform decontamination tasks, tools and materials for rapid repair of key infrastructure elements are all areas where innovative ideas are needed.

Making transportation safer is a principle part of making the nation safer. The Federal Railroad Administration, the Federal Transit Administration, the Federal Motor Carriers Safety Administration, and the member state transportation departments of AASHTO are all supporting well-conceived efforts to do just that. ❖

The IDEA *Program Announcement* provides detailed information on the programs and on how to prepare proposals. It is available on the website at www.trb.org/idea. Proposals for the next review cycle are due by March 1, 2005.

Making the Nation Safer is available on the National Academy Press Web site at www.nap.edu/

Protecting Public Surface Transportation Against Terrorism and Serious Crime, Report No. MTI-01-14, by Brian M. Jenkins, is available on the Norman Y. Mineta Institute for Surface Transportation Policy Studies Web site at http://transweb.sjsu.edu/.

Special thanks to Tom Menzies, Senior Program Officer, Transportation Research Board, for his review of this article. It is based on the transportation chapter of *Making the Nation Safer,* to which he made significant contributions.

Deter, Detect, Respond, Recover

Detecting Bioterrorism in Real Time

An innovative laser technology could become the means of first alert should biological warfare agents be released in a transit subway station. The technology being developed by Science Applications International Corporation in Huntsville, Alabama, is expected to detect biological threats virtually in real time, identify the agent, and alert appropriate officials.

In stage 1 lab tests for Transit IDEA project 35, researchers defined and tested the methodology and determined that the technology does detect and identify the target biological agent, in this case anthrax. Further lab work involved developing optical filters to distinguish anthrax from closely related bacteria.

This fall, air samples collected from the New York City Transit subway system will be tested to detect and identify biological agents in the presence of normal particulate matter in transit subway systems. ❖

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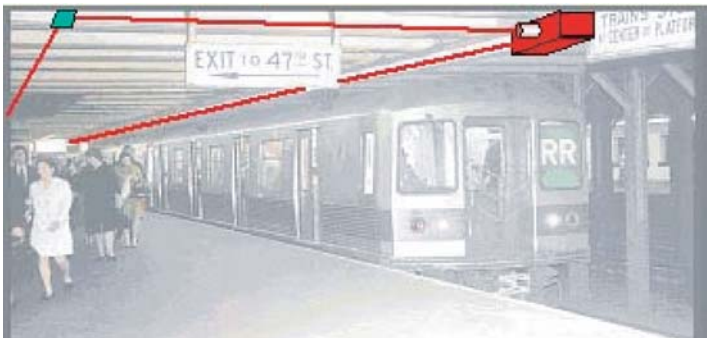
Bomb Busters: Detecting Radiation

Keeping track of radioactive materials as they are transported across the nation's rails and roadways and ensuring they won't be introduced into public transit settings is a critical aspect of transportation security. Work being done through a Transit IDEA project could result in a means to detect radiation and identify the type of radioisotopes that might be present through an inexpensive network of detectors and some elements of infrastructure already in place throughout our transit systems. Real-time detection of the type and amount of radioactive materials present in a subway station, for example, would inform emergency response efforts.

Based on gamma ray spectroscopy, new recognition algorithms developed by Advanced Fuel Research, Inc. in East Hartford, Connecticut, coupled with proprietary networking software, provides a sophisticated radiation detector with strong false-positive alert prevention. Development of REDSTAR™, the Radiation



Event Detection System: Tracking and Recognition, is expected to be relatively quick because the technologies have already been proven and commercialized. The Washington Metropolitan Area Transit Authority is participating with the investigators in Transit IDEA project 42. ❖

Contact:

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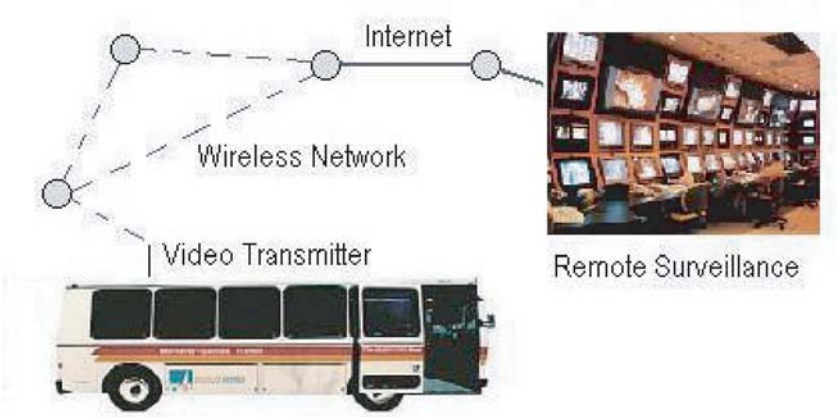
Broadening the Security Network

A system that could provide remote viewing, monitoring, and alerting functions to a central transit control facility is being investigated at Carnegie Mellon University in Pittsburgh. Typically, systems for monitoring activities on board transit buses have consisted of video and audio tapes.

Transit IDEA project 37 is testing improved methods of using a wireless network to deliver streaming video in real time from buses to a central transit control center. The system would use digital cameras on buses and add a broad-bandwidth wireless network modem and unique software to expand the bandwidth for wireless transmission of streaming digital video.



New methods of high-speed wireless data transfer, as well as new ways to encode and compress data have to be developed to expand bandwidth and allow for reconstruction of a video frame when losses occur due to decaying signal strength. Investigators are experimenting with two types of wireless network infrastructures for mobile video streaming. The Port Authority of Allegheny County has participated in developing and testing theses methods. ❖

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Sensing Danger

Improving sensors to detect chemical agents that could be released in transit systems and other open public venues is a high priority for enhancing transportation security.

In Transit IDEA project 40, researchers at Connecticut Analytical Corporation, Bethany, Connecticut, are testing the concept of combining an innovative air sampling technology with a chemical detector to achieve an efficient, real-time detector for chemicals such as Sarin, VX, other nerve agents and various explosives.

The work is based on technology developed by Dr. John Fenn, 2002 Nobel Prize winner for chemistry. Fenn developed the electrospray ionization technology to determine the weight of individual atoms or molecules to help identify a chemical species. This technology combined with the aerosol collector could be capable of real-time chemical detection.

Proof of concept testing is under way as a prototype system is developed. New York City Transit is participating in this project by providing guidance and assistance. Air samples have been collected from the New York City Transit subway system and will be used in testing to determine if the method can effectively detect chemical agents.

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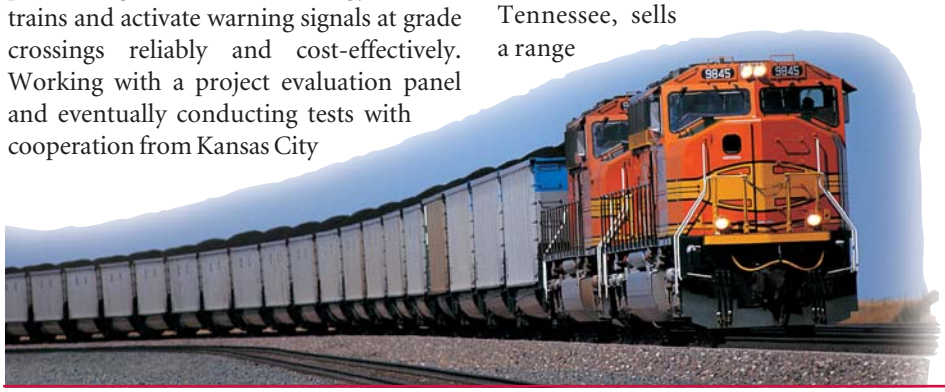
Perseverance Pays Off

In April of 1997, the Federal Railroad Administration invested a small amount of money so that an engineer could test an idea that might help reduce the number of fatalities and injuries related to railroad operations. The FRA funded a High-Speed Rail IDEA project to develop a grade crossing warning system that used an alternative to conventional track circuits to detect the presence of a train. The principal investigator was Joe O'Conner, an engineer who proposed using microwave technology to detect trains and activate warning signals at grade crossings reliably and cost-effectively. Working with a project evaluation panel and eventually conducting tests with cooperation from Kansas City Southern Railroad and Burlington Northern Santa Fe Railroad, O'Conner was able to evaluate range and train-speed sensor accuracy, false alarm rate, and the accuracy and consistency of advanced warning time. By the end of the IDEA project, there were promising results and much more work to be done.

Happily, O'Conner continued developing the technology and now O'Conner Engineering, Inc., headquartered in Union City, Tennessee, sells a range of products based on the ability to measure distance and velocity using microwaves. The products include equipment that will detect trains advancing at high or low speeds and flash warning lights powered by solar panels; a track obstruction sensor that detects cars, trucks, and people on the tracks, then flashes a strobe light to warn the train engineer of the obstruction; sensors to precisely measure ground speed of vehicles moving over various types of terrain; and sensors configured to protect track workers by alerting them of an approaching train. Other product lines employing the same basic concept are also available from the company. ❖



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