Photo courtesy of Oak Ridge National Laboratory

R-TECH™ NEWSLETTER
The Newsletter of the First Responder Technologies Program

Volume 3 • Issue 5 • May 2010

To contact R-Tech
E-mail: RTech@DHS.gov

IN THIS ISSUE

Surge Protector
Superconductor Cable Prevents Electric Grid Blackouts

Spotting Threats
Magnetic Imaging Technology Detects Liquid Explosives in Sealed Containers

Broader View
InterAgency Board Widens Focus to Benefit First Responders

Responder Knowledge Base
Feedback Implementation: Users Asked, RKB Listened

Homeland Security
Science and Technology

This Newsletter discusses technologies of interest to first responders that have received funding, in part, from the government. Mention of these technologies should not be construed as an endorsement of either the technology, or the entity producing it, by the Federal government.

To download a copy of this newsletter, visit:
http://www.firstresponder.gov/Pages/NewsLetterPage.aspx?NewsLetter=current

SURGE PROTECTOR

Superconductor Cable Prevents Electric Grid Blackouts

More than 40 million people were plunged into darkness when electrical service failed in large portions of the Northeastern and Midwestern United States and Ontario, Canada on Aug. 14, 2003. Though many workplaces ceased functioning without electricity, New York City's emergency medical services had to deal with a doubling of call volume during the 29-hour blackout, according to a 2006 report in Prehospital and Disaster Medicine. Cardiac and respiratory complaints increased, likely due to commuters being left without subway transportation or elevators, according to the report. Paramedics responded to a large number of heat-related medical calls because air conditioners could not function. Ambulances struggled to navigate streets that lacked functioning traffic signals and were crowded with commuters walking home.

The Department of Homeland Security (DHS) Science and Technology Directorate (S&T) is supporting a technological advance that could reduce the chances of similar blackouts occurring in the future. The Directorate's Homeland Security Advanced Research Projects Agency (HSARPA) helped fund the development of an electrical cable that could be used to link substations, providing backup sources of electricity in the event part of the grid experiences an outage. The Resilient Electric Grid project will help ensure the nation's utilities can withstand power surges that cause blackouts.

Electric utilities have hesitated to connect substations in the past, according to Sarah Mahmood, program manager for HSARPA. Although one substation can compensate for another's outage if the two are linked, there is a downside to building an interconnected grid. If an equipment failure, terrorist attack, or lightning strike causes a power surge, also known as a fault current, that fault current can cascade through the grid and knock out every substation and piece of equipment connected to the problem site. Part of the Resilient Electric Grid project is the development of a superconductor cable designed to suppress fault currents that can potentially cause permanent equipment damage. This technology will allow electric companies to link substations without running the risk of fault currents cascading through the electric grid. "This will help [first responders] by keeping that backbone [of the electric grid] up and running," Mahmood said.

Oak Ridge National Laboratory tests the interface between a superconductor cable capable of suppressing surges that could otherwise damage the electric grid and conventional copper cables. Photo courtesy of ORNL.

In 2007, HSARPA awarded a contract to American Superconductor Corporation to develop an inherently fault-current limiting high-temperature superconductor cable (IFCL-HTS), also known as Secure Super Grids, which was the first of its kind. A superconductor offers no resistance to electricity flowing through it, thus eliminating power loss incurred with regular wires. In order to do this, however, the superconductor must be super cooled to -460°F. According to Jason Fredette, director of corporate communications for American Superconductor, when a large fault current travels through the grid, the

Surge Protector (continued)

superconductor cable heats up and stops conducting, effectively suppressing the power surge. "The wire itself can act as a smart switch," Fredette said.

What makes IFCL-HTS cable unique is that it operates at a higher temperature than traditional superconductors, -320°F, which makes it more practical for use. American Superconductor and its partner Southwire Company developed a 25-meter IFCL-HTS cable that was tested at Oak Ridge National Laboratory (ORNL) in 2009. According to Dr. Christopher Rey, senior staff scientist at ORNL, the lab plans to test an improved version in the near future.

In addition to preventing surges, the IFCL-HTS cable can improve electrical service to dense urban areas, according to David Lindsay, director for distribution engineering at Southwire Company. Superconductor cables can carry up to 10 times more electricity than a typical copper cable, and superconductor cables transmit electricity with near zero resistance. The added capacity and efficiency is useful for large cities such as New York, where electricity demand is rising and underground space to run additional cables is limited. The fault current-limiting superconductor cables are best suited for urban markets, according to Lindsay. In rural areas, he explained, it would likely be more affordable to use overhead power lines and other solutions to suppress power surges. As developmental testing of the cable concludes, HSARPA will explore the possibility of installing the IFCL-HTS technology in a selected location in the electric grid for an operational demonstration, according to Mahmood.

Another aspect of DHS's Resilient Electric Grid project focuses on developing a stand alone fault current-limiting device that can be installed anywhere on the existing electric grid, according to Mahmood. DHS is collaborating with Silicon Power to develop a Solid State Current Limiter. A semiconductor switch in the device suppresses power surges in electric cables. The technology would allow utilities to incorporate surge protector capabilities into the infrastructure without replacing current cables or existing protection schemes. DHS is scheduled to hold a demonstration of that technology's key elements at the KEMA, Inc. testing facility in Chalfont, Penn. in the fall of 2010.

Oak Ridge National Laboratory tests a surge-suppressing superconductor cable. Photo courtesy of ORNL.

These solutions would protect critical infrastructure dependent on electrical power from blackouts that not only threaten safety, but commerce as well. Power outages cost the nation approximately $100 billion a year, according to HSARPA. Having a resilient electric grid will protect Wall Street and other financial centers from power outages, according to Fredette. "If New York City goes black, that damages our economy," he said. "This project employs superconductor technology to protect our nation's financial centers."

For more information on HSARPA, visit www.dhs.gov/files/grants/gc_1247254578009.shtm. For more information on ORNL, visit www.ornl.gov.

SPOTTING THREATS

Magnetic Imaging Technology Detects Liquid Explosives in Sealed Containers

Terrorists can hide liquid explosives in an object as innocuous as a shampoo bottle. To mitigate this threat, the Transportation Security Administration (TSA) now strictly limits the amount of liquid that can be carried onto airplanes. A new scanning device that is akin to the magnetic resonance imaging (MRI) machines used in medical diagnostic applications has the potential to clear the way for larger containers to return to the skies. The Magnetic Vision Innovative Prototype (MagViz) – a technology supported by the Department of Homeland Security (DHS) Science and Technology Directorate (S&T) – can examine the liquid contents of a sealed container and determine whether the contents pose a threat.

X-ray machines are effective at detecting metal objects, such as guns and knives, but are less so in spotting dangerous liquids, according to Stephen Surko, program manager for the Directorate's Homeland Security Advanced Research Projects Agency (HSARPA), the entity that funded the development of MagViz. To address this shortcoming, Los Alamos National Laboratory (LANL) researchers created MagViz, which is similar in size to an airport x-ray machine.

MagViz surrounds an object in an ultralow magnetic field. The free protons inside the examined object's molecules line up in the direction of the field. By measuring the way the object's protons line up and how quickly they revert to their normal orientation after the electromagnet is turned off, MagViz can identify the substance and determine whether it poses a threat. "It can identify just about any liquid based on its molecular structure," Surko said. "It's kind of like detecting the molecular fingerprint of an item."

The Magnetic Vision Innovative Prototype can detect liquid explosives inside sealed containers. Photo courtesy of Los Alamos National Laboratory.

In addition to airport screening, the MagViz technology could be applied to other law enforcement activities, according to Surko. Similar screening technology could be used at courthouses and other government buildings for security. If a handheld version is developed, it could be used to check whether individuals are carrying liquid explosives. The technology also has potential applications for the hazmat field, according to Surko. Hazmat teams responding to a chemical release could identify an unknown substance using MagViz. Identifying the chemical quickly would help first responders determine whether to evacuate the area and what types of personal protective equipment to wear. MagViz could identify unknown substances found during methamphetamine laboratory raids and other incidents.

Many current explosive and chemical detectors search for traces of substances that have dripped, spilled, or leaked from a container, according to Al Urbaitis, research technologist at LANL. If a suspicious container is sealed, such traces might not be detected. Examiners could open each container to check its contents, but that is often not a safe or practical option. For example, airport screeners do not have sufficient time to open each container they screen. MagViz can pinpoint threats without the examiners having to open any containers.

By detecting slight magnetic variations created by the device's electromagnet, MagViz can peer through containers to scan the contents inside. Metal containers cannot block the scan, according to Urbaitis, due to the magnetic field's low frequency. With this capability, MagViz can scan the contents of a bottle when it is underneath, or even inside, another container. Even a layered container, such as a Thermos, cannot fool the system.

When MagViz screens the objects placed on its conveyor belt, screeners see a color-coded image taken by the MRI technology, according to Larry Schultz, technical staff member at LANL. The system highlights any suspicious containers that should be examined more closely. "MagViz

Spotting Threats (continued)

makes an image of each bottle and then [determines whether] that bottle's signature is something you wouldn't want a passenger to take on a plane," Schultz said. HSARPA and LANL tested the technology at the Albuquerque International Sunport Airport in December 2008. That prototype was designed to scan small objects and groups of items, according to Surko. The technology eventually will be used to scan entire pieces of luggage. LANL published a report on the test and the MagViz technology at http://iopscience.iop.org/0953-2048/23/3/034023.

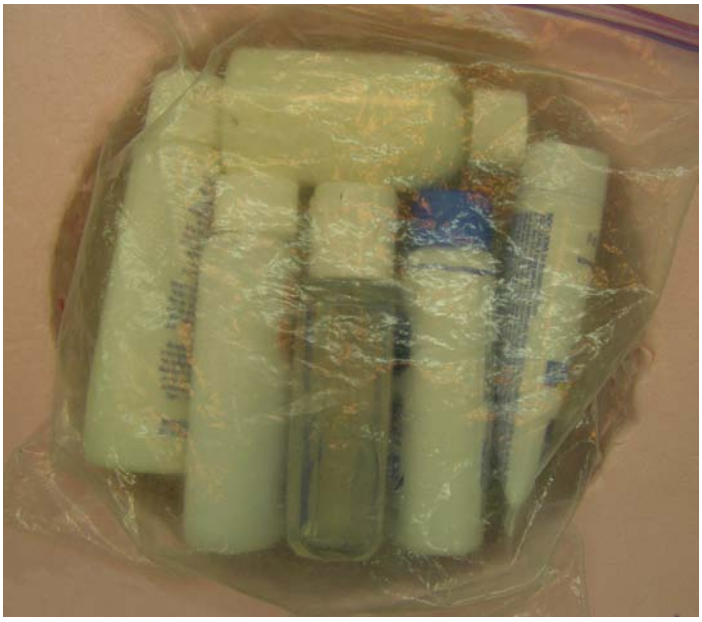
During the December demonstration, TSA personnel offered input on the MagViz interface to ensure the final version is easy for screeners to use, according to Urbaitis. TSA also supplied items confiscated from passengers to test the capabilities of MagViz. Those items showed researchers what kinds of substances the technology needs to be able to detect. "It allowed us to check the instrument against real-life objects," Urbaitis said. "The instrument behaved very favorably."

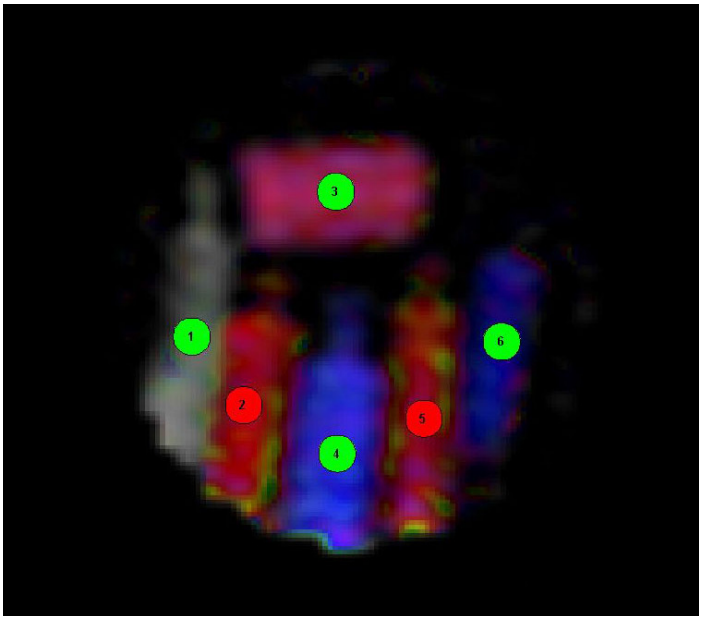
Another demonstration is scheduled for September 2010. LANL hosted a workshop in March 2010 for vendors interested in commercializing the technology. Some vendors expressed interest in licensing the technologies associated with the project, according to Urbaitis. The technologies could be applied in the medicine or food sciences fields as well as security, according to Surko.

LANL is researching ways to build a smaller and lighter version of MagViz. The current design is a 5-foot by 6-foot by 6-foot box. LANL is developing a microwave-size version of the device for screening individual bottles, according to Schultz. In the future, the device potentially could be transported to a hazmat or crime scene in a vehicle, or the MagViz technology could be further miniaturized to support a handheld version.

MagViz represents a major leap forward in screening capabilities, Surko noted. Airports have relied on x-ray technology to screen luggage for decades. "What we're trying to accomplish with MagViz is a revolutionary advancement," he said.

For more information on MagViz, visit www.lanl.gov/p/focus_on_physics/lalp-08-070.pdf. First responders who would like to discuss the capabilities of MagViz and explore potential applications of the technology may contact Surko directly at stephen.surko@dhs.gov or 202-254-6876.





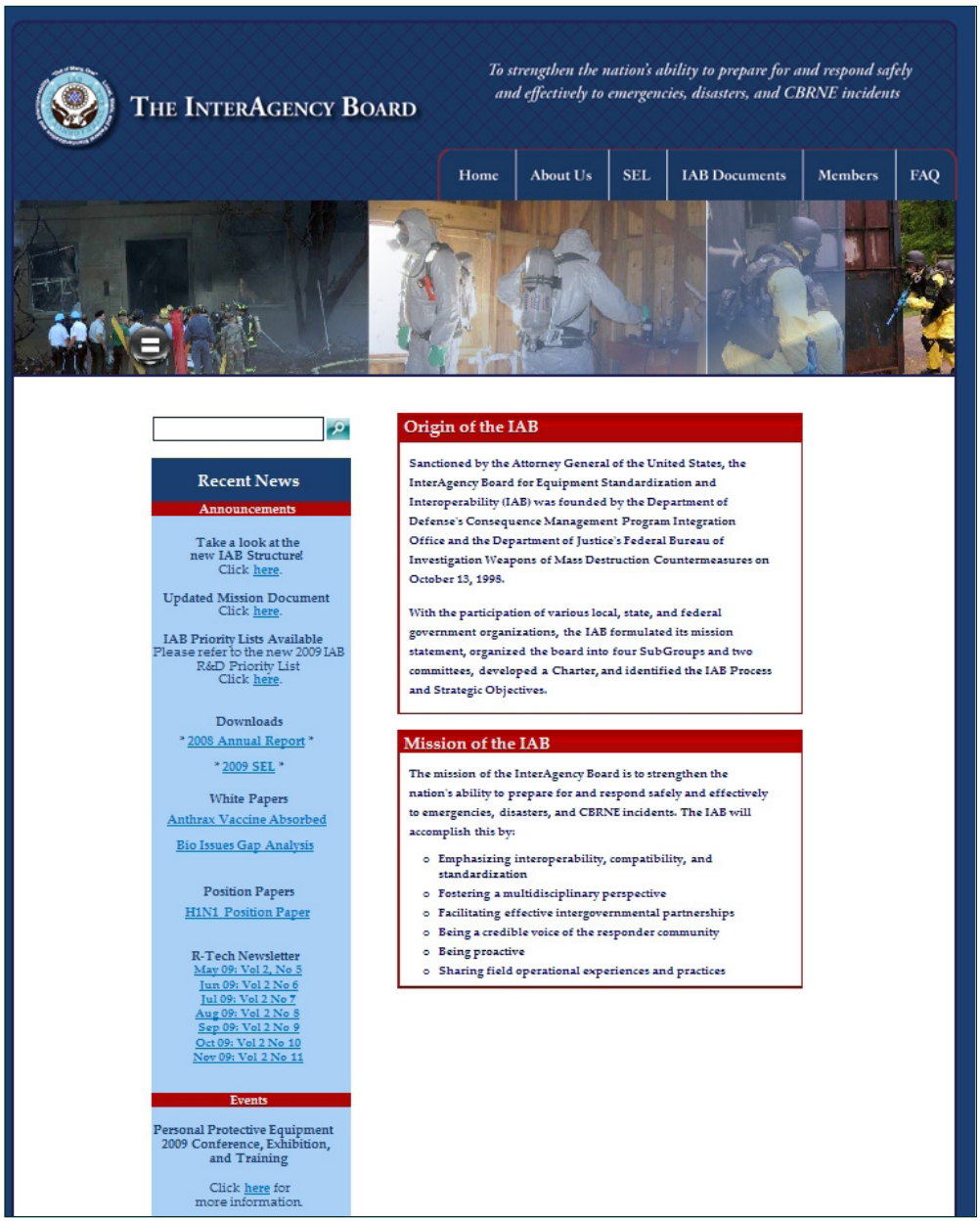
The Magnetic Vision Innovative Prototype can detect any suspicious substances inside bottles like these. The device's scanned view is shown on the right. Photos courtesy of Los Alamos National Laboratory.

BROADER VIEW

InterAgency Board Widens Focus to Benefit First Responders

The InterAgency Board for Equipment Standardization and Interoperability (IAB), a user working group of and for first responders, is broadening its scope beyond just equipment and addressing interoperability challenges. As the result of a strategic reorganization that began last year, the IAB is expanding its focus to address training, policy, and other needs of the first responder community.

The mission has not changed, but the IAB's restructuring will help the organization better accomplish its goals, said David McBath, a New York State Police staff inspector and the IAB deputy chair. "We're trying to work together to enhance capabilities that exist, and fill gaps for capabilities that don't currently exist in the first responder community," McBath said.



The IAB redesigned its Website, https://iab.gov, in 2009 to make it more user friendly and to incorporate information about the group's structural reorganization. Image courtesy of the IAB.

Established in 1998, the IAB is supported by volunteers from various federal, state, and local government agencies and organizations. Sponsored and co-founded by the Department of Defense (DoD) Consequence Management Program Integration Office and the Department of Justice (DOJ) Federal Bureau of Investigation Weapons of Mass Destruction Countermeasures unit, the IAB focused on creating equipment standards and eliminating interoperability challenges facing fire service and hazmat teams during its early years.

The IAB membership now includes first responders from the fire service, law enforcement, health, emergency management, military, emergency communications, agriculture, and public works communities. "It allows for a variety of different disciplines that otherwise may not have an opportunity to sit together and discuss their issues," said Kathleen M. Higgins, chairwoman of the

Broader View (continued)

Federal Agency Coordinating Committee and chief of stakeholder relations for the Department of Homeland Security (DHS) Science and Technology Directorate (S&T) Command, Control and Interoperability Division.

The IAB offers a broad perspective on issues facing the first responder community because of its diverse membership, according to William Deso, a program manager for the DHS S&T First Responder Technologies (R-Tech) program who serves on the IAB Science and Technology SubGroup. The IAB works to address issues facing the entire community, across disciplines and geographic boundaries. "They're very dedicated and very focused on trying to improve safety for first responders and their response capabilities," he said.

The IAB is currently funded by DHS S&T, DHS Grants Program Directorate, DHS National Preparedness Directorate, DHS Office for Interoperability and Compatibility, DHS Office of Health Affairs BioWatch program, DoD Joint Program Executive Office for Chemical and Biological Defense, and the National Institute for Occupational Safety and Health (NIOSH) National Personal Protective Technology Laboratory.

IAB members communicate first responder needs to federal policy makers, according to A.D. Vickery, IAB chairman and assistant chief of risk management for the Seattle Fire Department. For example, the IAB surveys members each year to determine technology research priorities for the first responder field. IAB members identified 22 technology priorities in 2009. The IAB priority lists from 2009 and past years are available at https://iab.gov/PriorityLists.aspx.

Logo courtesy of the IAB.

The focus of the IAB will continue to be on responder health, safety, and effectiveness. The new structure will assist in accomplishing the short- and long-term goals set by the membership and federal partners. The IAB mission calls for emphasizing interoperability, compatibility, and standardization. The IAB also aims to provide a venue for first responders to share field experiences and practices. Research showed that first responder members and federal participants held about 70 percent of the same goals for the organization, according to Vickery.

The IAB is organized into seven SubGroups: Standards Coordination; Science and Technology; Equipment; Strategic Planning; Information Management and Communications; Training and Exercises; and Health, Medical, and Responder Safety. The SubGroups are co-chaired by a first responder and a federal agency representative, and are staffed with members and subject matter experts in their respective areas of interest.

The IAB streamlined volunteers' meeting obligations by changing the user working group's SubGroup structure, according to Higgins. The reorganization limited the amount of overlap between SubGroups so IAB members could address topics more effectively and efficiently.

The IAB also redesigned its Website, https://iab.gov, to add a user-friendly toolbar and incorporate information on the revamped structure. The new organizational structure, the IAB Charter, and the Strategic Plan are detailed on the Website under the About Us tab. The charter thoroughly describes the makeup of the IAB, including the organizational structure and member roles and responsibilities. The Strategic Plan outlines the purpose, objectives, standards development process, and the operation of the IAB.

For more information, visit https://iab.gov.

RESPONDER KNOWLEDGE BASE

Feedback Implementation: Users Asked, RKB Listened

The Responder Knowledge Base (RKB), located at www.rkb.us, actively solicits feedback and recommendations from users through multiple venues, including the RKB feedback page, the online help desk, and conferences. Through these sources, they have received many comments on various topics from first responders, government officials, and public users. RKB considers all comments valuable and evaluates each for relevance for future implementation.

Based upon feedback received in 2009 and 2010, the RKB made changes to its products section, the Federal Emergency Management Agency Preparedness Grants section, and others. Below are some examples of user feedback and how RKB addressed that feedback:

- **Feedback:** "Information is difficult to navigate; you should divide it by subject area."

  Implementation: RKB created subcategories in the training and grants sections to make browsing easier. Training subcategories are now broken down by discipline: EMS, Fire, HAZMAT/WMD, Law Enforcement, NIMS/IMS, and Other. Grants are now categorized under FEMA Preparedness Grants, Department of Justice Grants, Assistance Programs, and Other.

- **Feedback:** "List the date of any updates made."

  Implementation: RKB introduced a "Page Last Updated" field for all records.

- **Feedback:** "Examples of Mutual Aid Agreements and Standard Operating Procedures (SOPs) would be helpful."

  Implementation: RKB researched and uploaded new content on mutual aid agreements and SOPs.

- **Feedback:** "I am interested in receiving a live tutorial."

  Implementation: RKB scheduled live tutorials for interested users in March and April 2010. The RKB will continue to provide tutorials when there is interest. Future tutorials will be announced on the RKB Website.

- **Feedback:** "Consider grants calendar" and "Simplify grants information."

  Implementation: RKB plans to publish a grants calendar in May 2010.

RKB continues to evaluate all feedback received as it is vital to its continued success.

To submit feedback to RKB, visit: www.rkb.us/feedback.cfm. To contact the RKB help desk, e-mail RKBMailbox@us.saic.com or call 1-877-FEMA-RKB (1-877-336-2752).

Print

USFA Special Report: Fires Involving Medical Oxygen Equipment

Publisher: U.S. Fire Administration
Publication Date: March 1999
Author: Miller, T.H.
Pages: 50

U.S. Fire Administration | FEMA

USFA

Description

The United States Fire Administration has noted with growing concern the number of flash fire incidents linked to lightweight, portable oxygen equipment. The following report describes the general hazards associated with oxygen-enriched atmospheres, including aluminum in contact with high-pressure oxygen, a number of recent incidents, maintenance recommendations, and contributing factors are also included.

This report contains information on ten flash fire incidents that involved either fire service or emergency medical service personnel. The incidents resulted in serious injuries to emergency personnel and property damage, including the loss of two ambulances and considerable destruction to a fire station.

Submitting Organization:
United States Fire Administration
16825 South Seton Avenue
Emmitsburg , MARYLAND 21727
UNITED STATES
(301) 447-1189 or (800) 561-3356
Email: USFA-Publications@dhs.gov

The Responder Knowledge Base added a "last updated" field to Website entries at the request of users. Photo courtesy of RKB.