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POWERS OF DETECTION

Researchers Use Nuclear Technologies to Identify Explosives

Nitrogen-rich chemical compounds, such as fertilizers, have been used to make improvised explosives such as the one used in the 1995 Oklahoma City bombing and explosives that terrorists planned to use to attack a London shopping mall and other busy locations in 2004. To prevent bombings and attempted attacks like these, police must be able to quickly and accurately identify nitrogen-rich explosives. To make it easier to spot these threats, researchers are building a prototype to identify nitrogen-rich bombs from a standoff distance as part of a project supported by the U.S. Marine Corps (USMC).

Researchers at Kansas State University and M2 Technologies, Inc. are using nuclear techniques to pinpoint explosives, according to Mark Richter, program manager of the USMC Marine Expeditionary Rifle Squad. The Signature-Based Radiation Scanning technology could result in a standoff bomb detection (SBD) device that analyzes both gamma and neutron radiation to determine – at the atomic level – whether a target contains conventional explosives. The SBD device's beam emits radiation at levels similar to a medical x-ray, according to M2 Technologies Deputy Program Manager Tom Dunn. The radiation emitted by the device is below the Nuclear Regulatory Commission's public exposure safety limits. Law enforcement or military users would operate the device remotely, away from the beam and the source of the radiation.

The gamma rays are similar to the technology used in an x-ray machine, according to Dr. William L. Dunn, associate professor in the Department of Mechanical and Nuclear Engineering at Kansas State University, who is Tom Dunn's brother. The rays are used to determine the density of a suspicious material. Nitrogen-rich explosives are 60 to 80 percent more dense than a typical hydrocarbon molecule. If the gamma rays show a suspect material has the density characteristic of an explosive, the SBD device hits the target with a neutron beam. The beam's energy excites the atoms in the unknown material. The device can identify the material based on the way the excited atoms react since every isotope of every element produces a unique response to nuclear forces.

Laboratory tests found the technology could detect even small quantities of explosives, according to Richter. The current technology can identify a likely explosive in a matter of minutes, and researchers would like to decrease that time, Dr. Dunn noted. "We're trying to do something that's quick and easy and doesn't require as much time and radiation [as other explosive detection methods]," he said.

Researchers at Kansas State University are developing a prototype to detect nitrogen-rich explosives hidden inside suitcases and other containers. Photo courtesy of M2 Technologies, Inc.

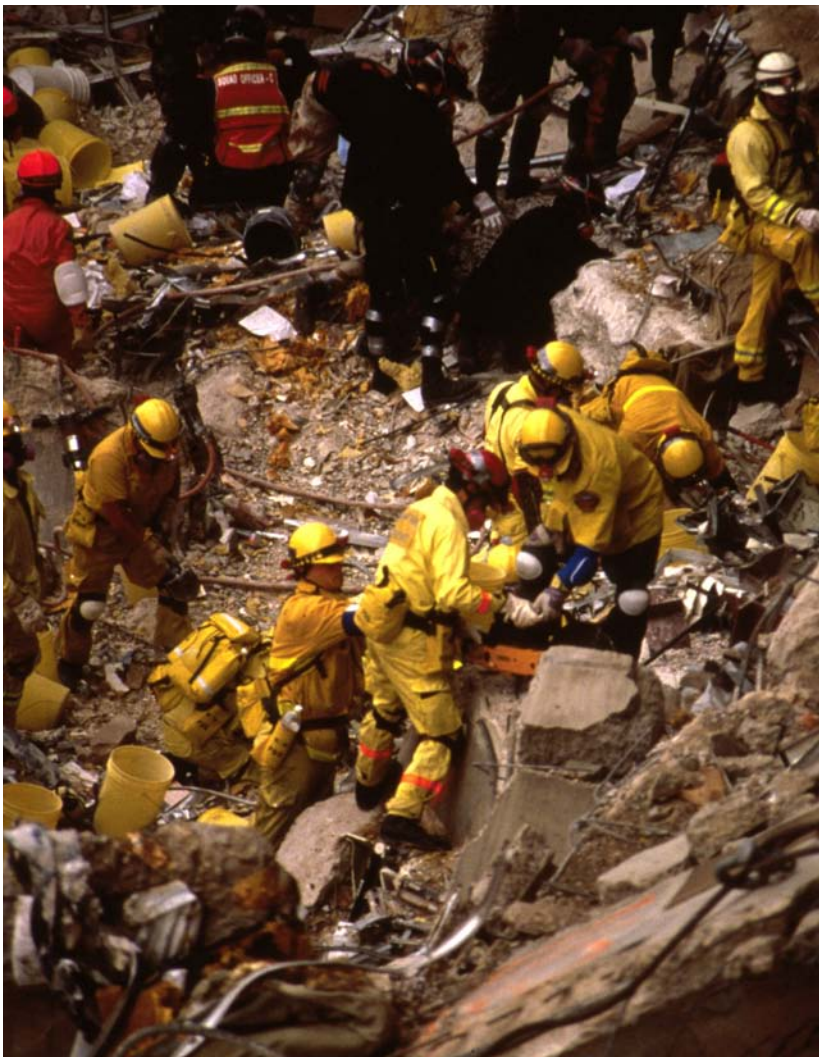
The Signature-Based Radiation Scanning device could help police detect explosives similar to the one that destroyed the Oklahoma City federal building in 1995. Photo courtesy of the Federal Emergency Management Agency.

The technology can be operated remotely, according to Dr. Dunn. When Kansas State University student researchers operate the SBD, the device, located two rooms away, can analyze materials. Researchers have tested the device's

Powers of Detection (continued)

ability to detect materials inside suitcases and other containers and soon will be testing materials hidden in car trunks, backpacks, and many other objects.

Police would benefit from a tool that could screen vehicles and packages for explosives, according to Lincoln, Neb. Police Department Assistant Chief Jim Peschong. During the past 15 years, officers have become more aware of the risk explosives pose in the hands of terrorists. Police also need technology that allows them to easily scan for explosives without impeding the flow of pedestrian or vehicular traffic in crowded areas, he added. "The use of standoff technology allows law enforcement to focus their efforts and resources where there is a higher likelihood of a threat," said Peschong.



The Signature-Based Radiation Scanning technology is designed to identify nitrogen-rich explosives like the bomb that destroyed the Oklahoma City federal building in 1995. Photo courtesy of the Federal Emergency Management Agency.

The goal of researchers at Kansas State University and M2 Technologies is to develop a device that can find explosives inside of other objects and from a standoff distance, keeping first responders safe from potential explosives. "The farther away you can detect a bomb, the easier it is to react to it and not be in harm's way," said Tom Dunn. During the summer of 2010, researchers at M2 Technologies and Kansas State University expect to finish building a laboratory prototype that can detect explosives up to several meters away. The SBD device could then be mounted on a robot and moved close to a suspected explosive in order to perform an analysis.

As the technology develops, SBD devices that use Signature-Based Radiation Scanning could be mounted on vehicles and used to scan for improvised explosive devices. The technology would make it easier for police to detect explosives in abandoned vehicles or at security checkpoints. "The [SBD technology] could, once fully developed, be used to detect the same materials used in the Oklahoma City bombing of the [Alfred P. Murrah] federal building by Timothy McVeigh," Richter said.

In addition to nitrogen-rich explosives, first responders could use Signature-Based Radiation Scanning techniques to detect other chemicals, according to Dr. Dunn. The technology ultimately could be employed to screen freight for smuggled drugs. Hazmat crews could use the technique to check chemical spill scenes for flammable materials.

A prototype is expected to be developed for field testing in three to five years, according to Richter.

For more information, visit www.m2tech.us or www.uol.ksu.edu.