HOMELAND SECURITY

Detection Technologies

Enhanced warning of terrorist threats

Context

The ability to detect terrorist attacks—either before they occur or in the early stages—is pivotal to preventing the act or mitigating the intended harm. Developing effective detection technology requires addressing the unique challenges posed by each class of weapons.

For radiological and nuclear weapons, detection equipment must be able to sense radiological signatures from hidden sources. Detection tools for conventional explosives must often sense extremely low amounts of residue. Because pre-attack detection of chemical and biological weapons is very difficult, the challenge lies in detecting a release as quickly as possible to minimize casualties and damage.

When successfully commercialized, our MicroChemLab units will give emergency responders a rapid, handheld tool for detecting chemical and biological weapons.

Solution

Our developments in sample collection and preconcentration, microfluidics, and miniaturization have enabled sophisticated detection systems that are finding application from buildings to borders to battlefields.

A Sampling of Sandia's Detection Technologies and Systems

Chem/Bio Detection

Sandia is creating highly accurate detectors for chemical and biological agents based on major advances in microfluidics and miniaturization that promise rapid field analysis—potentially saving lives and limiting damage.

Lab on a chip. Now nearing commercialization, Sandia's handheld MicroChemLab™ devices could allow first responders to identify chemical and biological hazards within minutes. Highly sensitive and accurate, the chemical detector can identify toxic chemicals from 10 to 100 ppb, and the biodetector can identify biotoxins to 1 ppm, even in dusty conditions.

Facilities protection. An automated network of chemical sniffers, TV cameras, and computers developed by Sandia and Argonne National Laboratory is providing the Washington, D.C. Metro system with reliable early warning of a chemical attack, as well as optimized emergency response management. Sandia researchers have also worked with the San Francisco International Airport to test a system of sensors that could alert authorities to a bio-aerosol attack in an airport—a key target for terrorists.

BioBriefcase. A joint venture between Sandia and Lawrence Livermore National Laboratory is creating BioBriefcase, a portable bio-agent detector. Using capillary electrophoresis, DNA amplification, immunoassays, and protein signatures, BioBriefcase will identify bacteria, viruses, and toxins. Sample preparation and analysis will be carried out on microfluidic, chip-based modules.

Outdoor warning. SnifferSTAR™, a half-ounce chemical sensor, mounts on the wing of an unmanned aerial vehicle to detect possible nerve gas attacks on cities, military bases, or battlefields. Another Sandia technology, Ares, is small enough to mount in the back of a van. It can scan the atmosphere above high-risk facilities or events, using ultraviolet (UV) laser-induced fluorescence to detect biological aerosols.

Rad/Nuc Detection

Sandia is building on its significant radiation detection capability—gained through decades of ensuring the security of the U.S. nuclear stockpile—to create a valuable array of tools for sensing the types of weapons terrorists might use.

Ports and checkpoints. The Sensor for Measurement and Analysis of Radiation Transients (SMART) uses Sandia's patented software algorithms to identify gamma and neutron signatures of materials passing within several meters, even when the isotopes are hidden. SMART, which is undergoing testing at a major U.S. port, can be mounted on a fixed portal to screen moving vehicle traffic, or on a mobile cart to scan stationary sources. Sandia is also working with port authorities to develop procedures to respond to SMART alarms while minimizing disruptions to operations.

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Urban protection. The prototype Hybrid Emergency Radiation Detection Network (HERD) monitors radiation levels and alerts authorities to a suspected attack. Thanks to wireless communications, these small (2" x 2"), battery operated sensors can be scattered over a large area without compromising communication to the central computer.

Explosives Detection

Sandia's patented sample collection and preconcentration technology has dramatically advanced the art of trace explosives detection, enabling small, fast, affordable systems that can detect explosives vapor and particles from sub-fingerprint amounts of residue.

The Sentinel, the commercial version of Sandia's explosives detection personnel portal, puffs air on occupants to dislodge particles for chemical analysis. In TSA's extensive pilot program, the Sentinel screened passengers at several major U.S. airports, including New York's John F. Kennedy International Airport.

Personnel portal. Sandia has developed an innovative walk-through personnel portal that detects trace amounts of explosives to parts per quadrillion. Now licensed to Smiths Detection, it is commercially available as the Sentinel. Based on successful tests conducted in 2004 at numerous airports, the Transportation Security Administration (TSA) announced it would purchase 25 Sentinels from Smiths Detection. TSA plans to add more machines by January 2006 to provide fast, accurate explosives detection capabilities at the nation's 40 busiest airports.

Vehicle portal. The vehicle portal screens a vehicle for trace levels of explosives contamination and vapor while passengers and cargo remain inside.

Portable sniffers. Sandia combined its advanced collection and preconcentration technology with a commercial explosives detector to create Hound™, a hand-portable device that enables the trace detection of explosives. Next, Sandia integrated sampling, preconcentration, and its own microsensors into a single platform. The resulting 12-lb, toolbox-sized MicroHound is sensitive enough to detect explosives residue in a fingerprint. Both systems can collect either vapor or particulate samples for analysis. The expected $10K cost to mass produce a commercial MicroHound unit compares well to the $20K to $30K cost for current commercial handheld systems.

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Learn more at
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