PSU data fusion software is brain for new chemical weapon sensor

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By combining three different chemical vapor detectors with data fusion software developed at Penn State's Applied Research Laboratory (ARL), researchers have developed a prototype system to reduce the number of false alarms from trace chemical weapon sensors.

Dr. David C. Swanson, associate professor of acoustics, ARL senior research associate and leader of the development team, says, "All known portable chemical detection technologies that work for trace vapor concentrations outside the laboratory have problems with false alarms. These false alarms can cause evacuation of a facility, unnecessary use of chemical protective gear and eventually complacency to electronic detections that are actually true.

"Over a broad range of vapor concentrations, we were able to virtually eliminate false alarms in the 41 test trails conducted so far in which one or more of the three individual chemical detectors was in error," he adds.

The prototype development team is led by Swanson and Andrew F. Mazzara, director, Institute for Non-Lethal Defense Technologies, and includes an interdisciplinary team of ARL scientists and engineers as well as Department of Chemistry faculty members. The project is supported by the Marine Corps System Command, through the Marine Corps Research University (MCRU) Program at Penn State.

The Multi-Sensor Analyzer/Detector (MSAD), as the prototype is called, combines a flame photometer, an ion mobility spectrometer and a

surface acoustic wave array to simultaneously and continuously sample air in its environment for chemical weapon vapors.

Swanson explains, "Each of these sensors is capable of detecting chemical vapors at non-lethal exposure levels. However, each sensor has vulnerabilities to false detections from common chemical vapors such as diesel exhaust and cleaning products."

The ARL software is a continuous inference network or CINET (pronounced see-eye-net). It operates like the reasoning process a weapons inspector would go through when trying to make a danger determination based on the data from the chemical vapor detectors. For example, when the detectors sense a vapor, the CINET performs this reasoning process: If this is mustard gas, what is the range of data values one should see in the flame photometer, the ion mobility spectrometer and the surface acoustic wave array? The CINET will reject false alarms by an individual detector when the other detectors do not corroborate the data or if the data from all of the detectors falls outside the ranges for chemical weapons.

Through a cooperative research and development agreement between Penn State and the U.S. Army Edgewood Chemical and Biological Center, ARL researchers developed a database of responses for all three sensors over a wide range of weapons chemical concentrations and interferants. Interferants are chemicals, such as cleaning supplies, that could be misinterpreted as dangerous by a detector. All testing and analysis on toxic materials is performed at Edgewood.

The ARL software architecture allows the device to be operated from a secure location, remote from the area under surveillance, or as part of a mobile unit. Data also can be transmitted over secure computer networks and displayed as websites.

Kuchera Defense Systems of Windber, Pa., supported the research effort and has built a prototype for testing by the Marine Corps System Command. The company will manufacture the MSAD units.

The CINET was originally developed at ARL by James Stover for use in an autopilot for underwater vehicles.

Source: Penn State