Protecting Public Places From Terror

"Systems engineering approach" offers a new paradigm that stresses prevention.

@ A "systems engineering approach" is needed to protect closed public spaces, such as airport terminals, from potential chemical or biological terror attacks, says a Georgia Tech professor of chemistry. Devices to sense these agents are only part of an overall strategy.

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ABOVE RIGHT: Protection for closed public spaces such as airport terminals and shopping malls needs a "systems engineering approach" that includes central command centers, response strategies tailored to the facility, and protection of water and air circulation systems, says Professor Art Janata.

In protecting public spaces such as buildings and aircraft from potential chemical or biological terror attacks, an ounce of prevention may be worth a pound of sensing.

Since the 2001 anthrax attacks, research has focused on developing improved sensors to detect potential chemical or biological terror agents. But these devices themselves cannot head off terrorist attacks, and while they should be part of an overall protection strategy, reliance on such technology can create a false sense of security, warns a Georgia Institute of Technology researcher.

Protection for closed public spaces such as airport terminals and shopping malls therefore needs a new paradigm: a "systems engineering approach," argues Jiri (Art) Janata, a Georgia Tech professor of chemistry who specializes in sensing and analytical instrumentation. That systems approach would include central command centers, response strategies tailored to the facility, protection of water and air circulation systems —and neutralizing and sterilizing chambers built into air-circulation systems to limit the spread of terror agents.

Janata, who is also a Georgia Research Alliance Eminent Scholar, discussed these issues in an American Association for the Advancement of Science meeting presentation earlier this year. His talk summarized the results of a 2002 National Science Foundation-sponsored symposium on the challenges of chemical and biological sensing in homeland security.

"Correctly applied technology can improve security, but incorrectly applied technology — such as reliance on sensors that may or may not detect the actual agent being used — could create a false sense of security," Janata says. "We need to think about everything in terms of a "Systems Engineering Approach." Very little has been done to integrate comprehensive systems."

Using sensors to protect public buildings faces two major challenges: There are too many potential chemi-

BY JOHN TOON

cal and biological agents to reliably detect, and even with the fastest sensors, some people will become victims before the sensor can respond and an alert can be sounded.

Sensor development has so far focused mostly on a "short list" of toxic agents originally developed for military battlefield use. But Janata warns there are many other non-military gases that could be just as deadly in civilian spaces — and for which no sensors are available or no sensors have been deployed.

"The problem with the whole sensing strategy is the presumption that you would know what is going to be used as a toxic agent," he says. "Unless you were in correspondence with the terrorists, you would not know that, so the selectivity of the sensors — defined in terms of 'toxicity' rather than a specific toxic compound — becomes an issue that makes the whole chemical sensing effort largely useless."

Should a toxic gas be released in a public building, the time required for the agent to reach a chemical sensor would be about the same as the time required for the agent to reach potential victims. "You must accept that there will be casualties in the event of an attack like this," Janata adds.

Based on that realization, agencies such as the Defense Advanced Research Projects Agency (DARPA) have been promoting the concept of "immune buildings" that actively protect their occupants. This protection would come both from making buildings less attractive targets and from automated systems that would remove toxic agents from the indoor air.

"Almost every public building in the United States has a heating and air conditioning system that circulates the air," Janata notes. "Not only does that refresh the air, but it also provides a vehicle for introducing both chemical and biological agents. The concept would be to insert into that HVAC system a sterilization chamber that would disable the biological agents and decompose the chemical agents."

A chamber exposing the air to ultraviolet light could inactivate most biological agents. And because of their reactive nature, most chemical agents could be neutralized with a small number of chemical processes built into filtering systems.

"Some such technologies already exist," Janata says. "With some additional development, they could be implemented in public spaces."

He compares this protective approach to the treatment systems cities have used for decades to ensure clean drinking water. It's also similar to the approach taken in hospitals, which sterilize instruments because surgical infections are easier to prevent than to treat.

Once a threat has been detected — either by sensors or by observing the distress of building occupants — the next step will be to choose the most appropriate response, such as evacuating a building or closing an airport. Deciding how to respond to a chemical or biological attack may take considerably more time than would be required to detect the attack itself.

To improve that decision-making process, large public facilities should have central command centers with extensive monitoring capabilities including sensors, video cameras and other technologies.

"These events should be monitored from a central control room, which would develop the proper level of response," Janata explains. "You need to avoid overreactions because they actually cause more economic damage than the actual attack. That gives the terrorists what they want."

Effectively assessing the potential danger of a toxin requires not only knowledge of its physiological toxicity, but also its physical characteristics. For instance, in some situations a toxic gas that doesn't disperse well could be less potent than a much less toxic agent that easily disperses. Thus, some of the most-feared chemical agents may pose a lower risk than chemicals familiar to industrial chemists, Janata notes.

Facility operators also need to look beyond chemical and biological agents to consider other forms of attack, including use of explosives, commando-style assaults or efforts to disrupt computer networks, Janata adds.

Information about the January 2002 NSF workshop is available online at: **www.chemistry.gatech.edu/sensingforum-02/**.

@ Read more at: **gtresearchnews.gatech.edu/newsrelease/systemseng.htm**

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Art Janata, professor of chemistry

BELOW: Professor Art Janata advocates a "systems engineering approach" for protecting public places from terrorism attacks.

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