mer Georgia Tech Professor Nan Jokerst and Associate Professor Martin Brooke, now at Duke University.

Meanwhile, their collaborators at Colorado State University and the University of Michigan are working on microfluidic sensors with a fully integrated design.

Detecting Fluorescence Changes in Polymers

A type of highly fluorescent polymers called PPEs, or poly(paraphenyleneethynylene), could be the basis for a chemical sensing system that would detect pathogens and toxins that might be used in a bioterrorism attack. The

Seaport Security

Innovation center working with academia and industry to develop new logistics and security technologies.

BY T.J. BECKER

When it comes to the operation of seaports, security and efficiency challenges are closely linked.

"We could generate 100 percent security simply by locking the 'front doors' of ports, but obviously that would have drastic consequences to U.S. commerce," says Page Siplon, director of the Maritime Logistics Innovation Center (MLIC) in Savannah.

He points to the Georgia Ports Authority (GPA), which contributes more than $35 billion annually to the state's economy and has a hand in providing jobs for one out of 14 Georgians. "Anything we can do to enhance the shipping process will generate more revenue," he adds.

MLIC is the first of Georgia's innovation centers, an initiative launched by Gov. Sonny Perdue in 2003 to spark economic development in mid-sized cities throughout the state. Located at Georgia Tech's Savannah campus, MLIC is a unique partnership between GPA, the Georgia Department of Economic Development and the University System of Georgia. MLIC is working with private industry to develop new technologies and adapt existing ones for the safe, efficient movement of freight.

Take external tracking and tracing. Seaports typically operate on a queue system where trucks arrive at port gates and enter a first-in/first-out processing system, relaying information about whether they are delivering or picking up goods along with the contents of the cargo. If all goes well, this only takes a few minutes. But whenever there is a problem — be it a security issue or a simple error in paperwork — long delays result and slow the movement of freight.

"By the time a truck arrives at the gate, it's almost too late to do much about a security concern," Siplon says. Because of long lines of traffic, seaport authorities have few options but to move vehicles forward and deal with any problems on site, he explains: "If we could start the information exchange before trucks reach the port, we would have time to do deeper security validation and could re-route vehicles if anything is questionable."

With that in mind, MLIC is creating a "mobile test-bed" to see how various technologies such as global-positioning systems (GPS), general-packet radio service (GPRS) and radio-frequency identification (RFID), can be combined to improve external tracking and tracing. Aiding in this project are American Port Services, CarrierWeb and Cingular, three of MLIC's first member companies.

Other MLIC projects include:

- **Internal tracking and tracing**. RFID tags can help locate cargo, but when several levels of containers are stacked in the port yard, reception problems proliferate. So MLIC wants to find ways to improve asset visibility. MLIC's research is expected to result in the formation of new companies.
- **Scanning and detection**. U.S. Customs and Border Protection agents use various technologies

> "If we could start the information exchange before trucks reach the port, we would have time to do deeper security validation. . ."
>
> — **Page Siplon**, director of the Maritime Logistics Innovation Center

inBrief

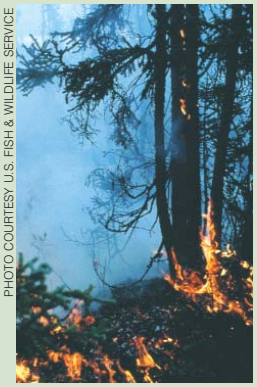

PHOTO COURTESY U.S. FISH & WILDLIFE SERVICE

Georgia Tech Research Institute engineers are working with the Georgia Forestry Commission to adapt the Geographic Tool for Visualization and Collaboration (GTVC) to track smoke during planned burns of forested land. Other potential applications for GTVC include tracking of chemical plumes and planning evacuation routes, as well as tracking of human and animal diseases. Georgia Emergency Management Agency officials also use GTVC for hurricane and flooding evacuation planning and for public event activity planning.

agents of concern include cholera, anthrax and ricin.

"Fluorescence is very sensitive to the chemical environment," says Uwe Bunz, a Georgia Tech professor of chemistry. "So it's a very good tool to report changes."

With a one-year, proof-of-concept grant from the National Institutes of Health, Bunz is exploring the feasibility of detecting changes in the fluorescence or color of PPEs when they interact with a pathogen or toxin. But the goal has presented some technical challenges.

PPEs are typically not soluble in water, but for use as sensors, they must be, Bunz says. So researchers added very polar, water-like extensions to the lipophilic, or butter-like, substituent chemical side chains that extend from the long chemical backbones that form PPEs.

Researchers must also make PPEs mimic the sensing functions of human cells in a primitive way, Bunz explains. On the surface of pathogens and some toxins are proteins called lectins that bind with sugar molecules on the surface of human cells to attack them. Similarly, Bunz wants to add sugar molecules to the chemical side chains that extend from PPEs. Then he will see if these sugars bind with lectins.

Researchers have been synthesizing a library of PPEs and other polymers with sugars attached, and they have begun early-stage testing of these materials.

"We've done a little of this lectin sensing, but to do this better, we need to use longer extendable linkers for the sugars attached to our polymers," Bunz says. "It's a major challenge to do this."

If the concept proves feasible, Bunz will seek additional funding and collaborate with a biosafety laboratory that can work with the pathogen anthrax and/or the toxin ricin.

@ Read more at: **gtresearchnews.gatech.edu/reshor/rh-f04/danger.html**

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PHOTO COURTESY GA. DEPT. OF ECONOMIC DEVELOPMENT

to search incoming shipments for explosives, radioactive materials and illegal immigrants, but existing tools have limitations. For example, bananas and television sets can cause false positives in some radiation-detection devices.

- **Distribution-center tracking and tracing**. Faculty researchers are analyzing how technologies affect the supply chain. Participants include Georgia Tech Professor Chip White, MLIC's executive director, and trade and logistics expert Karl Manrodt, an assistant professor at Georgia Southern University.

Looking at the entire supply chain is critical because a solution that might work well for one partner could cause problems for another, Siplon notes.

@ Contact: Page Siplon at 912-966-7867 or page.siplon@atdc.org. Read more at: **gtresearchnews.gatech.edu/reshor/rh-f04/seaport.html**

GTRI scientists and engineers successfully demonstrated the operation of their chemical sensor mounted in the nose cone of the U.S. Defense Department's miniature unmanned aerial vehicle (UAV) called Dragon Eye. Next, they want to shrink the sensor from its current one-half-pound size to about one ounce. Then they plan to mount sensors on each of the UAV's wings to get a more precise reading on the source of a chemical plume.

PHOTO BY GARY MEEK