UF researchers refine system to detect explosive materials

June 10 2011, by John Dunn

Airport security workers this year will employ an array of pre-boarding detection measures to scan for deadly materials smuggled into the luggage of the world's 625 million passengers expected to travel this year.

None, however, yet uses what researchers at the University of Florida believe is the world's first explosive detection system that utilizes ultraviolet light to zero in on specks of dangerous explosives found on these items.

"We are absolutely the only one using differential reflectometry," said one of the system's inventors, Rolf Hummel, a professor emeritus in UF's department of materials science and engineering.

Hummel also thinks that had his team's detection system been in place last October, it would have detected an explosive package disguised as a printing toner before it slipped past airport inspectors in Yemen and ended aboard a jet in Dubai preparing to fly to the U.S. A tip from intelligence agents, not technology, eventually averted a tragedy.

The detection system also may have provided an extra layer of protection to airport workers. "Our goal," said Hummel, "for our technology is for it to make speedy decisions at security check points and minimize the involvement of human beings to keep them safe."

The fully automated device is based on patented technology pioneered at

UF five years ago by Hummel and fellow UF researcher Paul Holloway that utilizes the science of differential reflectometry.

The scanning process begins when UV light shines on pieces of [luggage] moving on a conveyor belt commonly used in [airport security] systems. Any residual amounts of TNT or any other explosive powder on the surface of these objects absorb the incoming light at specific varying wavelengths, depending on the chemical makeup of the material. The system instantly provides a spectrographic analysis of the absorption spectrum of the light after it has been reflected back into the device.

The computer compares this "fingerprint" with those of known explosives stored in its memory. If a match occurs, the device beeps to alert security officers.

Programmers also have equipped the system's computer with algorithms — a sort of digital instruction manual — that are designed to allow the detection device to consider all the possibilities that are sent to it, including fingerprints of new or unknown explosive materials that may emerge in the future, explained Thierry Dubroca, a UF postdoctoral research associate, working on the project.

"Fingerprints of explosive materials," he said, "are unique and very recognizable."

Dubroca also is the CEO of Delta R. Detection, a Gainesville-based startup now gearing up to license the UF-patented technology to tap the growing worldwide explosives detection market, estimated to exceed $3 billion in the U.S. market alone.

So far, the research team has received about $1.4 million in federal, state and private money for product development.

Said Hummel: "I've been a scientist for 50 years and I've always wanted to something that really helps mankind. "I now feel satisfaction."

Provided by University of Florida