 By James E. Rickman

Airborne sensor technology assists emergency responders

SCIENTISTS AT LOS ALAMOS NATIONAL Laboratory and emergency first responders from the Environmental Protection Agency (EPA) have developed airborne infrared sensor technology that can aid emergency crews by detecting and mapping hazardous and toxic chemical plumes unleashed by disaster or terrorist acts.

The Airborne Spectral Photometric Collection Technology (ASPECT) is a high-tech sensor package mounted on board a small aircraft operated by the EPA that allows for timely surveillance of gaseous chemical releases from a safe distance. ASPECT gives emergency first responders on the ground critical information regarding the size, shape, composition, and concentration of gas plumes emanating from disasters such as terrorist attacks, derailed trains or factory explosions.

ASPECT is the result of more than five years of research and development by researchers within Los Alamos' Physical Chemistry and Applied Spectroscopy Group and the EPA. The project was supported by the Laboratory's recently created Center for Homeland Security, which focuses on providing technical support to the Department of Homeland Security and collaborating agencies.

"Protecting the homeland against terrorist threats is a great challenge that will require development and application of such dual-use capabilities as the EPA ASPECT system," said Gary Resnick, associate director of Chemical and Biological Threat reduction at the Center for Homeland Security.

THE SYSTEM

ASPECT takes advantage of two sensors mounted aboard an Aerocommander 680 aircraft operated by an EPA disaster first responder crew. The first sensor, called a Fourier Transform Infrared Spectrometer, detects and locates chemical vapors. It can peer through smoke and dust to get an accurate measurement of the location and concentration of a vapor plume. The second sensor, a high-resolution infrared line scanner, records an image of the ground below, as well as additional plume information.

PHOTO: LOS ALAMOS NATIONAL LABORATORY

A technician measures readings from ASPECT infrared sensors mounted on an Aerocommander 680.

Information from both instruments is combined with high-resolution digital imagery and Global Positioning System information to create an accurate map of the land surface and the chemical vapor plume hazard. ASPECT can show the main plume as well as places where gas has collected and settled, such as in low-lying areas or locations where there is little or no air movement. It takes only minutes to produce an image.

The vapor hazard plume map then can be transmitted to emergency response commanders on the ground—usually the local fire chief or emergency manager—by fax, computer, or other means. In areas where emergency responders lack computer equipment, ASPECT teams will drop a working computer via parachute to emergency responders before taking measurements themselves.

"By providing a capability to accurately measure and locate hazardous and toxic chemical plumes, emergency responders near disaster plumes will be able to make better decisions regarding civilian evacuations, resource deployments and ensuring the safety of response crews," said Robert Kroutil of Los Alamos' Physical Chemistry and Applied Spectroscopy Group.

The system was rigorously tested under stringent real-world conditions and performed admirably. ASPECT also proved its usefulness in public by patrolling the skies over Salt Lake City during the 2002 Winter Olympics on the lookout for potential terrorist attacks.

Most recently, the plane was called into service in the wake of the space shuttle Columbia disaster. ASPECT's crew looked for extremely hazardous rocket fuels, which fortunately had evaporated before they reached the ground. But in the course of their surveillance, ASPECT's cameras also recorded the location of larger pieces of debris, which aided recovery efforts.

An ASPECT system can cover a multi-state area, reducing the amount of resources needed for an emergency response. HDJ