Protection from the Sky

ASPECT flies high to protect citizens, environment from toxins

Quick read
Los Alamos' stealth airplane technology detects chemical and radioactive dangers—like a superhero vehicle but more advanced than what you see in the movies.

"The threat right now is just people in the area being told to stay away, to evacuate. So hopefully, certainly, everybody did—did get out and heed those warnings. But right now, some people certainly feeling the effects of some of those chemicals, some of that stuff in the air. Still a situation we're keeping an eye on, and certainly, trying to find out the answer." Courtesy of CNN transcripts

On an early January morning in 1997 outside of Louisville, Kentucky, a transportation trail derailed and cars exploded, releasing smoke and chemical plumes. The above media quote portrays the fear and uncertainty people felt. Residents near the wreck reported skin irritation, a strange taste in their mouths, and an unpleasant feeling in their lungs. Authorities evacuated residents and, based on shipping manifests, determined that cyclohexane, a flammable, inhalation hazard, was onboard. A small plane based in Texas was called to the scene to determine what contaminants were rapidly spreading throughout the community.

ASPECT, the Airborne Spectral Photometric Collection Emergency Response Project, has been deployed many times to monitor crash sites, burning chemical facilities and wildfires. The plane also collects foreign intelligence to counter terrorist activities. The Environmental Protection Agency deploys ASPECT during massive hurricanes to collect information about potential toxins released by storm damage, after which hazardous materials responders are sent to alleviate risk to the community and the environment.

Similiar to the Batmobile, the ASPECT plane protects its crew while they race to the site of an emergency. However, unlike the fictional car, ASPECT goes one step further and collects chemical and radiation samples, preventing crew from entering dangerous sites—an erupting volcano or a toxic spill. The plane not only assists responders during national emergencies, it also protects citizens at major events that are at risk for terrorism, such as the Super Bowl or the Olympics.

Researchers at Los Alamos National Lab developed ASPECT. The plane, a twin-engine Aerocommander 680 aircraft is equipped with a multi-spectral infrared mapping system and a Fourier Transform Infrared spectrometer package called ASPECT. This airborne sensor is the only "stand-off infrared" detection tool in the nation devoted to emergency domestic response applications. The technology provides first responders with critical information regarding the size, shape, composition, and concentration of gas clouds. It can see through smoke and dust to get a measurement of the location and concentration of the vapor plume. A second sensor, a high-resolution Infrared Line Scanner, records an image of the ground below, as well as plume information.

The system then uses Global Positioning System mapping data and digital images of the site to create exact maps and digital data overlays of chemical plumes and low area locations where toxin-laden air may accumulate.

Within minutes of arriving on the scene, ASPECT data is collected and a field analysis is performed. The data is simultaneously sent to Los Alamos for more in-depth analysis. The full assessment, including data collection, takes less than 15 minutes.

Pushing Frontiers

In the second half of 2008, Los Alamos National Laboratory made significant advances in its primary mission: safeguarding the U.S. nuclear deterrent and pushing the frontiers of science on multiple fronts.

The national stockpile stewardship program achieved a major milestone in September with the production of the first life-extended W76-1 ballistic missile warhead for Trident submarines. The achievement culminated more than a decade of work by scientists and engineers at Los Alamos and across the nuclear weapons complex-including two crucial experiments conducted by the Laboratory's Hydrodynamic Experiments Division.

Another highlight: Roadrunner reached a new performance record of 1.105 petaflops, keeping it atop the list of the world's fastest supercomputers. Built by IBM for the Lab, Roadrunner was the first computer the crack the petaflop barrier: one thousand TRILLION operations per second. Initial applications will range widely: studying in great detail the evolution of HIV... exploring deeply the formation—as well as deformation—of metallic nanowires...and-toward producing biofuels more efficiently-unraveling the processes by which bacteria break down cellulose.

Safety and environmental stewardship were again a major theme for our work in the latter half of 2008. In November, the last group of unvented high-activity drums left Los Alamos for the Waste Isolation Pilot Plant near Carlsbad. That shipment fulfilled a commitment to the Defense Nuclear Facilities Safety Board to prioritize disposal of the highest-activity transuranic wastes stored at the Lab.

Los Alamos also strengthened security, ensuring that nearly six dozen classified and unclassified computing systems are managed and operated securely. The Lab has now complied with all 14 security actions mandated two years ago by the Department of Energy. And, through our program to recruit cognizant systems engineers, we met the crucial need for sufficient numbers of engineers to keep vital mechanical and electrical safety systems functioning properly in our nuclear facilities.

The latter half of 2008 proved once again why Los Alamos is the nation's premier institution for scientific research. Capping the list of accomplishments was a new technology called MagViz that could eventually provide increased security at major airports. Based on medical MRI technology, MagViz can identify contents of bottles and other containers, distinguishing potentially hazardous liquids from the harmless shampoos and perfumes a traveler might carry onboard a jet. MagViz was demonstrated successfully in December at Albuquerque's airport.

We continued a long tradition of supporting U.S. space exploration. A NASA mission, launched in October to probe the far edge of the solar system from a high Earth orbit, carried a Los Alamos device called the High Energy Neutral Atom Imager. Its goal: to detect atoms emitted from a region where the outermost reaches of our solar system meet the vast interstellar space-giving us a panoramic view of this gateway to the galaxy.

Closer to home, Los Alamos continues to explore solutions to the energy needs of tomorrow. For example, scientists at the Lab hope to use tiny semiconductors called quantum dots to convert sunlight to electricity more efficiently than is possible with current solar panels-and to create new, efficient solid-state lighting.

Equally electrifying, Los Alamos materials scientists are helping unravel the mysteries of superconductivity. During the latter half of the year, LANL researchers identified entirely new mechanisms for superconductivity that could form the basis for new superconducting materials.

Underscoring the wealth of scientific talent at the Lab, Bob Albers, Paul Johnson, and Kurt Sickafus were named Laboratory Fellows in December. These three Fellows represent diverse disciplines, including theoretical physics, energy science, and geophysics.

Los Alamos may be one of the world's great technology incubators, yet we also strive to help others develop new ideas and products. In January, the Lab selected four young local companies as the newest recipients of awards from the LANS Venture Acceleration Fund. LANS, which manages and operates the Lab, supports the fund through donations from its earnings.

The Lab and LANS also teamed last September with a venture capital firm and a local venture capital fund to spin off technology developed by Lab scientists, with an emphasis on creating companies in Northern New Mexico. The Lab could contribute up to one million dollars to the initiative over the first three years.

We also are pushing to build top-flight research facilities for the future. In July 2008, workers hoisted the final steel beam atop the skeleton of what will be the Radiological Laboratory Utility Office Building, part of the Lab's Chemistry and Metallurgy Research Replacement

Project. Once completed, the CMRR nuclear facility will house several of the Lab's mission-critical projects, including analytical chemistry, materials characterization, and actinide research and development capabilities. They'll be relocated from their current location in the historic—yet antiquated—Chemical and Metallurgy Research building at Technical Area 3.

In December, Los Alamos welcomed hundreds of employees who transferred from KSL, the subcontractor whose work the Lab brought in-house. The move was geared to improve efficiency and reduce costs associated with site-support services, including maintenance, waste removal, and custodial work.

Throughout the Lab's history, Los Alamos has helped play a vital role in the surrounding communities, and in 2008, that tradition continued. Lab employees pledged a million dollars, and LANS matched one hundred percent: a record Los Alamos contribution to United Way of TWO MILLION dollars. Contributions from the Lab and LANS also helped fund dozens of nonprofit organizations and scholarship programs, including a LANS donation of $500,000 to a LANL Foundation scholarship named for former long-time New Mexico Senator Pete Domenici.

These accomplishments and many more added up to a strong year. Our customer, the National Nuclear Security Administration, reached the same conclusion in its very favorable assessment of the Lab's performance for fiscal year 2008. It's unmistakable: the extraordinary talent, commitment, and creativity that Los Alamos employees dedicate every day to national security science and the betterment of their communities.