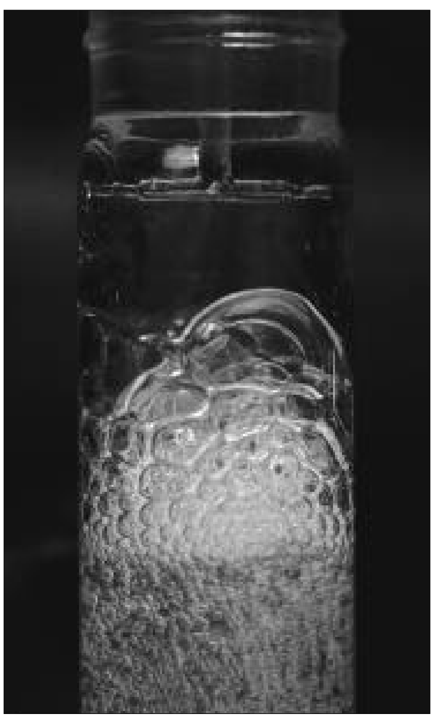
OCTOBER ISSUE 1996

LOS ALAMOS NATIONAL LABORATORY
WHERE SCIENCE MAKES A DIFFERENCE

DATELINE
LOS ALAMOS

RESEARCHERS LOOK FOR BUBBLE TROUBLE

NEW TOOL OFFERS A SAFER, CHEAPER METHOD OF MONITORING AND CONTROLLING FOAMING



The Foaming Capacity Monitor can measure anything that foams or bubbles. It can signal when a particular cleaning agent has been completely rinsed away during a cleaning operation. It also can signal when a surfactant's concentration is too high. Either scenario reduces the effectiveness of a cleaning or manufacturing process.

The need for the Foaming Capacity Monitor arose when Los Alamos researchers were seeking an online, inexpensive method of measuring low levels of surfactants. There were no commercially available methods or instruments that met their needs. Today, a working prototype of the Foaming Capacity Monitor is installed at Los Alamos' Waste Treatment Facility to be used to control effluent, or outflowing, foaming.

Monitoring levels of surfactants isn't new, but conventional processes used to measure surfactants are expensive, hazardous, and time-consuming. For example, one process uses chloroform, a carcinogen, for the analysis. Another technique involves the use of gas chromatography and takes 30 minutes to conduct one analysis. And a tensiometer instrument costs approximately $10,000 and requires a vibration-free environment.

Furthermore, these three techniques cannot measure a surfactant's concentration online, so samples must be taken to a laboratory for analysis. In this case, "online" means that the process stream is measured continuously at the source and provides results instantaneously.

This presents another problem — conventional tests require trained workers to perform the analysis. Because the Foaming Capacity Monitor conducts an online analysis, the information collected can be used to automatically adjust the process stream for optimal performance.

The Foaming Capacity Monitor solves the problems associated with conventional measuring methods. It uses no hazardous chemicals,

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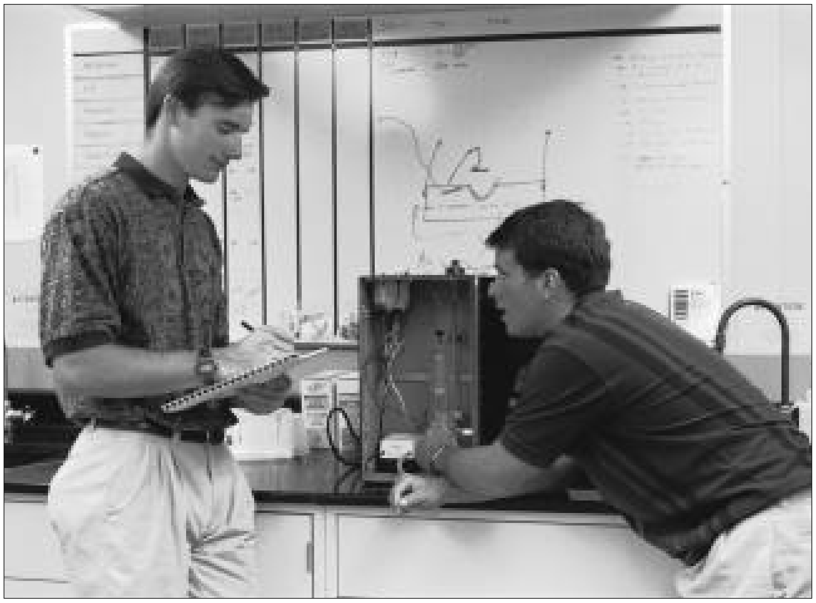

Los Alamos researchers Everett Neal (left) and Patrick Soran measure the foaming height of the solution in the Foaming Capacity Monitor.

thereby eliminating any potential harm to workers and the environment; it conducts continuous online measurements; it doesn't require trained personnel or complex algorithms to interpret the instrument's output; and it costs less than $1,000 to produce.

The Foaming Capacity Monitor also performs double duty: It functions as a monitor and as a process controller.

As a monitor, it measures surfactant concentrations for food-processing, paper production, electroplating, and for the textile industry. It monitors waste water by continuously checking the foaming potential of a discharge to eliminate any undesirable foaming of effluent. It also monitors oil in water, and head formation and stability in brewing or fermentation.

As a process controller, the Foaming Capacity Monitor holds surfactants to optimal levels for laundries and dry cleaners, as well as for paper production, electroplating, and textile manufacturing. It automatically maintains surfactant levels in electroplating baths. And the monitor controls foams in process environments by automatically feeding the exact amount of antifoaming agent into a process while minimizing chemical treatment.

The Foaming Capacity Monitor consists of custom-made glassware, an aquarium air pump, and commercially available photoelectric sensors. A solution flows continuously through the instrument. An overflow

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The Foaming Capacity Monitor consists of custom-made glassware, an aquarium air pump, and commercially available photoelectric sensors. The monitoring process measures a surfactant's concentration by blowing air through a glass frit which causes foaming. The in-flowing stream forces the foam down, achieving a stable height in the vessel. A light curtain then measures the height of the foam.

maintains a reservoir of fixed volume and height. Air is blown through the glass frit below the reservoir causing bubbling and foaming.

The in-flowing stream "washes" the foam and serves to force the foam down. The foam achieves a stable height in the vessel because of the equilibrium between the formation of the foam by air bubbles and the suppression of the foam by the in-flowing stream.

A light curtain measures the height of the foam. A photocell measures the amount of light passing above the foam layer. The photocell reading is converted to a 0- to 10-volt signal, with the voltage proportional to the concentration of the agent generating the foam. The in-flowing stream continuously washes the walls of the vessel, keeping the optical surfaces clean.

The voltage output can be used to drive a process variable in real time. For example, the Foaming Capacity Monitor can control the influx rate of antifoaming agents or reagents in paper manufacturing. The monitor also can signal when a process is completed.

Several companies have expressed an interest in the Foaming Capacity Monitor, and Los Alamos is seeking industrial partners to manufacture the technology for commercial use. Patents are pending.

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DATELINE: LOS ALAMOS

LOS ALAMOS ASSISTS IN HANTAVIRUS STUDY

BLOOD SAMPLES TAKEN FROM CAPTURED MICE WILL HELP TRACK RARE, DEADLY INFECTION

Los Alamos researchers are trapping hundreds of wild mice to help determine the incidence of hantavirus infection in the Southwest. Hantavirus causes a rare but deadly disease and is transmitted from rodents to humans.

Los Alamos is collaborating with the University of New Mexico School of Medicine in a five-year, $1.1 million hantavirus study funded by a grant from the National Institutes of Health. The study will determine the extent of hantavirus infection in rodents in New Mexico and Arizona, how the rate of infection varies from year to year, and what ecological factors cause this variation.

During the first recorded outbreak of the disease on the Navajo Reservation in 1993, Los Alamos researchers took samples in remote areas of Los Alamos County for the Centers for Disease Control and Prevention and the New Mexico Department of Health. Now the team is working in the Four Corners region for its third year of data collection in the five-year NIH-funded study.

Los Alamos is supporting UNM with expertise and equipment to collect and analyze the field data.

Additionally, because the Laboratory contains a great deal of open land and some old buildings, the researchers hope the study will help them develop a predictive model to alert Lab employees and others to take precautions if evidence indicates it might be a high-outbreak year.

Researcher Kathy Bennett anesthetizes a deer mouse prior to taking a blood sample.

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In the Four Corners region, the team sets out nearly 450 traps once a day according to a sampling grid. The traps, baited in the evening, are collected early the next morning. The captured mice are anesthetized, weighed, and measured for lean body mass — a measure of fat content and an indicator of the animal's health. Blood samples also are taken. The mice are released back into the wild by mid-day in the vicinity of where they were trapped.

Because mice are carriers of hantavirus, the work requires extensive personal protection equipment for the researchers, including respirators, surgical gowns, shoe and hair covers, and double gloves. All the equipment must be disinfected after every use.

In the afternoon, the research team collects information about the vegetation and amount of ground cover where the rodents were trapped. Other ecological data is compiled, including a survey of seed banks in the soil — factors that affect the health of the rodent population.

The team worked in the Four Corners region through Labor Day. It will take three to six months to process the collected data.

For the last four years, the team has been sampling mice in Los Alamos as well. The local study will alert the Laboratory to any danger of a hantavirus outbreak and serve as a baseline against which the Four Corners research can be compared.

According to the CDC, 143 cases of what is now called *Sin Nombre* Hantavirus infection have been reported in 25 states since 1993. Half of the people infected died from the disease.

Human infection with hantavirus commonly comes from inhaling dust contaminated by infected rodent urine and feces. Therefore, people working in places heavily populated by rodents are at the greatest risk of contracting the disease. An infection begins with flu-like symptoms that lead to labored breathing caused by fluid building up in the lungs. Ultimately, an infected person can die from an inability to breathe.

No cure or vaccine is yet available against hantavirus infection. The sooner after infection medical treatment is sought, the better a person's chance of recovery.

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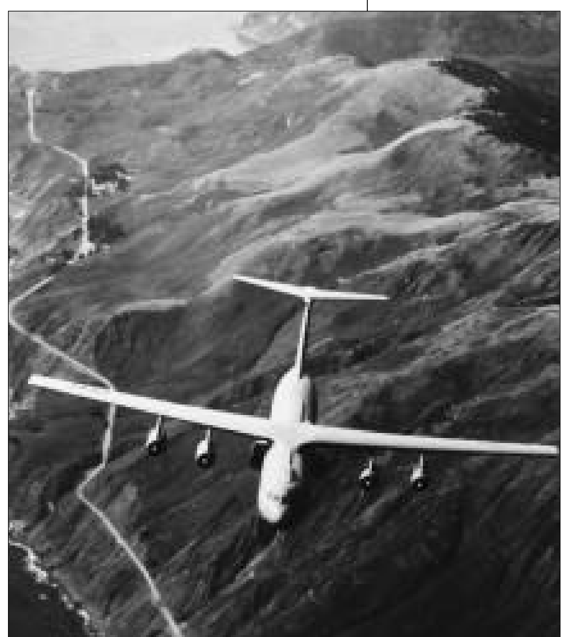
DATELINE: LOS ALAMOS

LOS ALAMOS AND INDUSTRY TEAM UP TO DEVELOP METHOD OF PROTECTION AGAINST SMALL-ARMS FIRE

FLEXIBLE LIGHTWEIGHT ARMOR PROTECTS PERSONNEL CARRIERS, AIRCRAFT, AUTOS, AND PEOPLE

It's twice as strong as steel, yet half the weight; so rugged, it's been used in combat to protect aircraft; so remarkably simple, it attaches to the material it protects with Velcro™-like ease. It's LAST, the modern-day equivalent of a medieval suit of armor.



LAST armor was designed to protect the crew and critical components of a C-141 aircraft from small-arms fire.

Originally, the Light Appliqué System Technique was designed to protect the U.S. Marine Corps LAV-25 armored personnel carrier from small-arms fire and shrapnel from exploding artillery shells. The U.S. Air Force was impressed with the armor's durability and turned to Los Alamos for help in adapting it to the C-141 aircraft. The Air Force specifically needed armor to protect the cockpit crew from small-arms fire such as the Soviet .30 caliber machine gun bullet. This rugged material also can provide law enforcement personnel protection from flying bullets or bank tellers protection from armed robbers.

LAST armor is a joint effort among Los Alamos, Lanxide Armor Products of Newark, Del., and Foster-Miller Inc. of Waltham, Mass. Lanxide Armor Products fabricated the tiles that make up the individual panels and mounted them on the Kevlar™ backing. Foster-Miller integrated the system of panels onto the aircraft by first applying a "hook and loop" attachment scheme, sizing the modular panels, and performing initial installation. Foster-Miller also provided directions on how to install future armor kits.

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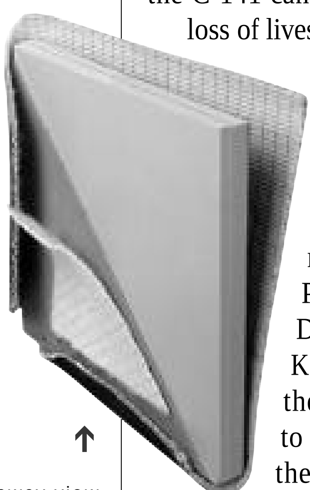
Although armor has been used since the medieval age to protect people and property, modern protection methods only date from the late fifties for ceramic armor and the early sixties with DuPont's introduction of Kevlar™. Kevlar™ is already used in items such as bullet-proof vests. With the LAST armor system, Los Alamos is extending Kevlar's™ use to new applications.

The first C-141 protected with an early version of the LAST armor flew into Bosnia in May 1995. A single bullet striking a vulnerable area on the C-141 can bring down one of these large transport aircraft causing loss of lives, aircraft, and supplies. The crew members were successfully protected from small-arms fire during the aircraft's relief missions. The Air Force subsequently installed armor kits in its C-17 transport aircraft in late 1995.



A cutaway view of an armor tile.

A LAST armor kit designed for the C-141 employs Foster-Miller's heavy duty hook-and-loop fastening material to adhere armor panels, made by Lanxide Armor Products, to the interior of the aircraft. Tiles made of Dimox-HT cermet, a composite material, are bonded to Kevlar™, an organic-composite-reinforced fabric, to form the armor panels. These panels are made in a variety of sizes to create a modular armor system that can optimally cover the areas to be protected, be installed quickly, and repaired easily if damaged in battle.

On the armored personnel carrier, the tiles are attached directly on the outside of the hull with the hook and loop attachments. Inside the aircraft, the tiles are mounted against the interior bulkheads lining the cockpit. Some areas of the cockpit contain no bulkheads, but the armor tiles can span across the gap and still be fully functional.

The official development of LAST armor began when the Air Force approached Los Alamos to produce an armor package for the cockpit of the C-141. Los Alamos solicited kits from several armor vendors and tested them all at Los Alamos at the appropriate protection levels. Each supplier submitted 10 single-shot panels consisting of 4-inch-square ceramic or cermet tiles mounted on polymeric backing.

The panels were tested by firing a shot into the center of the tile. Results showed that all bullets fired were defeated by all tiles tested. Lanxide was the chosen supplier because it was one of the top performers and its tiles cost less — a result of modularity and ease of installation using the LAST concept.

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→ The armor tiles are sandwiched between layers of fabric to form wall and floor armor mats.

Commercially available armor kits that use steel and aluminum are just as effective as LAST armor, but the LAST system has several advantages over other armor systems.

Ease of installation and less weight are two distinct advantages LAST armor has over competitors. Aluminum is too thick and occupies too much space in the cockpit. Steel is much heavier than cermet and must be made in smaller sizes to accommodate the weight limits allowed for personnel.

Ease of transfer from one aircraft to another is a major factor in the use of the LAST system of tile and Kevlar™ armor. A kit can be removed from one aircraft and installed in an adjacent one in less than two hours.

The LAST armor tiles used in the C-141 weigh only 7.75 pounds per square foot compared to the 12 pounds per square foot of the steel armor it replaces. A typical panel composed of the tiles is about 12 inches by 8 inches.

The cost to fabricate a LAST armor kit is much less than conventional methods, which cost two to four times as much.

Los Alamos researchers are investigating other applications for LAST armor. One concept will provide a portable and lightweight method of protection for police cruisers against small-arms fire.

Promising civilian applications include using the armor in counters, walls, and tops in convenience stores and in banks to protect clerks. Los Alamos has proposed to the State Department to use tiles in architectural configurations to protect embassies in foreign countries with high strife.

Lanxide Armor Products Inc. holds the patent on Dimox-HT cermet tiles; DIMOX is their registered trademark. Foster-Miller Inc. holds patents on the LAST armor system; LAST is their registered trademark.

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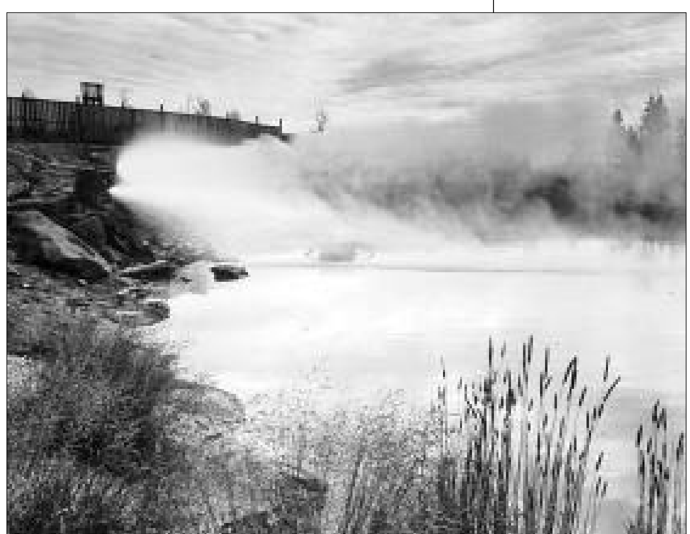
A HOT TOPIC

HOT DRY ROCK FORUM DRAWS PARTICIPANTS FROM AROUND THE WORLD

Nearly 100 scientists, engineers, and policy makers from around the world gathered recently in Santa Fe to discuss Hot Dry Rock, an alternative-energy technology by which the nearly limitless heat from Earth's dry rock interior can be mined for power production.

The Third International Hot Dry Rock Forum, sponsored by Los Alamos, featured keynote addresses by former Interior Secretary Stewart Udall and John E. "Ted" Mock, former director of the Department of Energy Geothermal Division.

Hot Dry Rock experts from as far away as Australia, Japan, and the former Soviet republic of Armenia discussed legal, economic, and technical issues related to the technology. The participants also toured the Fenton Hill Hot Dry Rock facility managed by Los Alamos.



↑ The Fenton Hill geothermal site is situated in the mountains west of Los Alamos.

Hot Dry Rock technology originated at the Fenton Hill site more than 20 years ago. At the site, researchers circulated water in a closed-loop system. The water gained heat from a subterranean rock reservoir and circulated back to the surface, where heat was extracted. The facility proved Hot Dry Rock to be a viable alternative energy source.

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Dateline: Los Alamos

LABORATORY DIRECTOR TO RECEIVE NAVY LEAGUE AWARD

GOLD MEDAL HONORS SCIENTIFIC CONTRIBUTIONS TO AMERICAN SOCIETY

➔ Los Alamos Director Sig Hecker will receive a Navy League Award.

Los Alamos Director Sig Hecker will receive the Navy League New York Council's Roosevelts Gold Medal for Science Award. The 10-year-old Roosevelts Gold Medal award honors an individual, corporation, or institution for extraordinary contributions through science to the security of America, according to the Navy League.

The award was named for Theodore and Franklin Delano Roosevelt, both former New York Navy League members, who contributed to the U.S. Navy Fleet's modernization. Hecker will receive the medal next month at a formal dinner in New York.

Retired Navy Adm. S. Robert Foley, who is president of Raytheon, Japan, nominated Hecker for his leadership in scientific endeavors such as the Trident missile program, Russian collaborations, satellite developments, advanced computer technologies, AIDS research, genome studies, and the breakthroughs in neutrino research and superconductivity.

"Under Sig Hecker's leadership and direction, Los Alamos National Laboratory has made and will continue to make dynamic and momentous contributions not only in science and technology, but to our national defense," Foley said in his letter of nomination.

The Navy League was formed in 1902 with cooperation and funding from Theodore Roosevelt. It serves as a civilian organization that speaks for the Navy and serves to educate and motivate Americans to support maritime capabilities, services, and personnel. ◆

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BRIEFLY ...

LOS ALAMOS RESEARCHERS SHARE EXCELLENCE AWARD. Two Los Alamos researchers were among members of a team who were awarded a Presidential Sandia National Laboratory Employee Recognition Award for excellence in teamwork. The team developed the first Atmospheric Radiation and Cloud Station — a self-contained monitoring station that will help scientists gain insight into Earth's global climate. As part of the Department of Energy's Atmospheric Radiation Measurement Program, the team, including Los Alamos researchers Bill Clements and Fairley Barnes, are trying to determine how the energy budget of Earth — the difference between the amount of energy captured by the planet and the amount lost to space — is affected by clouds. This information will be used to improve predictions of global climate change.

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http://lib-www.lanl.gov/pubs/dateline.htm

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