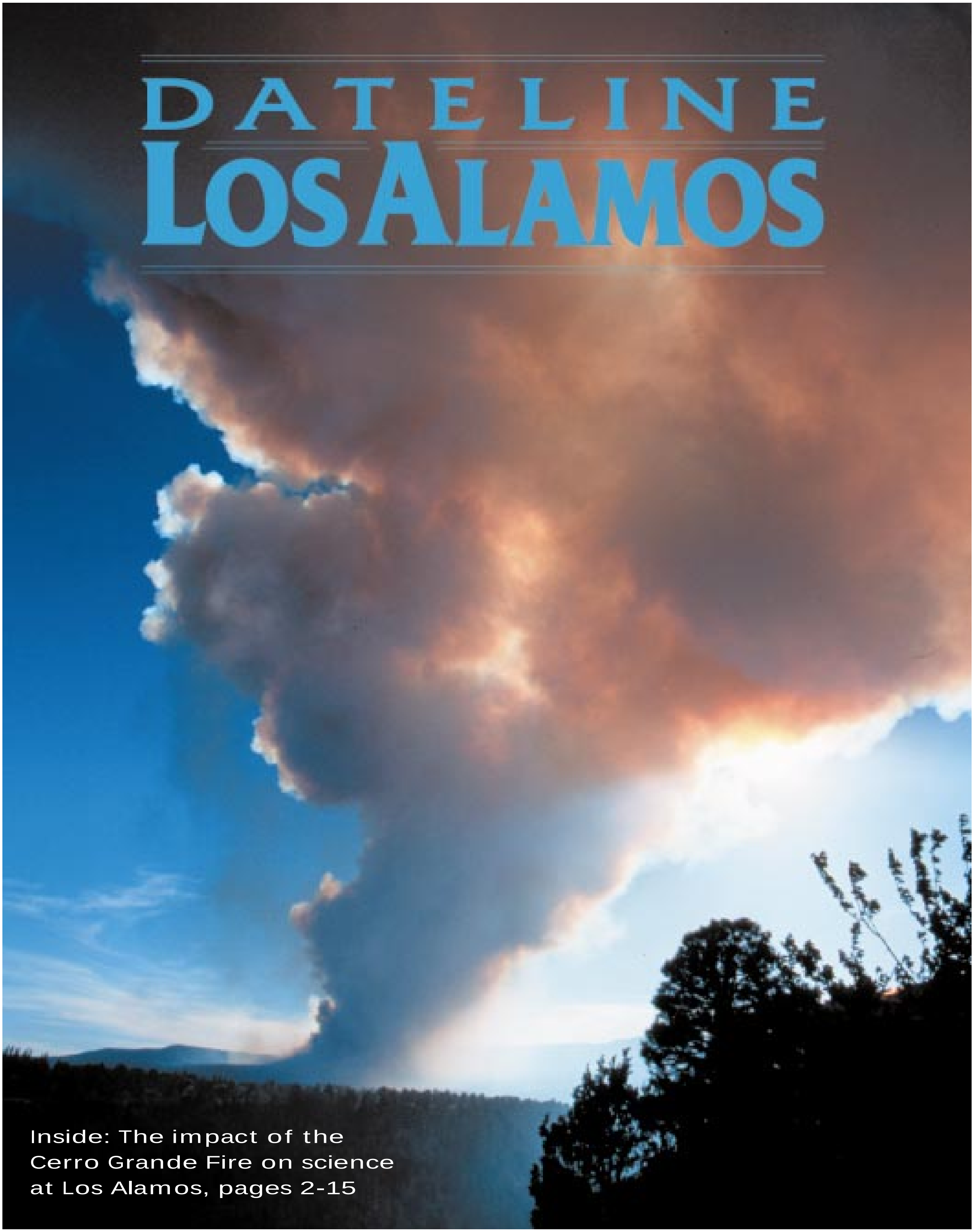
SUMMER ISSUE 2000

DATELINE LOS ALAMOS



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A MONTHLY PUBLICATION OF LOS ALAMOS NATIONAL LABORATORY

DATELINE: LOS ALAMOS

A GREAT LABORATORY COMES BACK

THE IMPACT OF THE CERRO GRANDE FIRE ON LOS ALAMOS SCIENCE

For several weeks in May, the Cerro Grande Fire roared across Northern New Mexico. As residents of the Los Alamos and White Rock communities fled their homes, millions around the world watched and waited as America's pre-eminent scientific laboratory faced the largest wildfire in recent New Mexico history. When it was over, Los Alamos emerged singed and smoky. Thankfully, no one was seriously hurt or killed, although hundreds of Los Alamos residents lost their homes. Still, the impact of the fire on science at the Laboratory was severe.

MENDABLE DAMAGE

The Cerro Grande Fire caused more than $300 million worth of damage to Los Alamos National Laboratory. More than 8,000 of the Lab's 27,000 acres were burned in the firestorm. Thirty-nine structures — mostly small storage buildings, but also several trailers that had served as offices — were destroyed in the blaze. Miles of power and communications lines that traverse the 43-square-mile laboratory complex were severely damaged.

LOS ALAMOS NATIONAL LABORATORY
WHERE SCIENCE MAKES A DIFFERENCE

DATELINE LOS ALAMOS

A MONTHLY PUBLICATION OF THE PUBLIC AFFAIRS OFFICE OF LOS ALAMOS NATIONAL LABORATORY

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Like a jewel in the ashes, the Los Alamos reservoir nestles in the charred flanks of the Jemez Mountains. The scenic spot, once a favorite local fishing hole, has been drained as a precautionary measure to limit the flooding that may occur during the annual monsoon season.

Looking like a huge bug, a Sikorsky sky crane hovers over the surface of the reservoir as it takes on a load of water. The reservoir served as a major source of water for the firefighters.

Smoke crept inside buildings and rare was the workspace not affected by soot. Hundreds of desktop computers may need replacement because of smoke damage. The fire came dangerously close to buildings at several sites, leaving the sensitive scientific instruments inside dusted with soot.

In one building, where fast chemical reactions are studied, several million-dollar laser systems were damaged after office trailers next door burned. The cost to clean the instruments will result in both direct cleaning expenses and valuable research time lost.

LOST TIME

The daily research work of much of the Laboratory fell behind schedule during the fire and is still recovering.

For instance, the timetable for the restart of the Los Alamos Neutron Science Center's Lujan Scientific User Center has changed. Although the only fire damage LANSCE experienced was to a sign across from the facility entrance, the shutdown and smoke cleanup have delayed critical work. The Lujan Center had planned to begin operations about the time the Cerro Grande Fire hit the Lab.

Operations at DARHT, the Dual-Axis Radiographic Hydrodynamic Test facility, also were affected when fire ravaged the surrounding forests and destroyed storage structures containing high-technology parts intended for use in the second phase of the DARHT facility construction.

IRREPARABLE DAMAGE

There was, of course, some irreparable damage done by the fire. The blaze consumed at least 20 personal computers and the scientific research stored on them. The research conducted by several postdoctoral scientists on Laboratory fellowships was lost when their office trailers went up in flames.

These losses, in particular, have serious career ramifications for the individuals, because postdoctoral research often is used to help the Laboratory and other potential employers decide whether to hire scientists when their fellowships end.

Another Los Alamos staff member's work — years of unclassified work on polymers — was lost when his office burned to the ground. These losses, and others like them, are devastating for the individuals and costly to the Laboratory.

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Portions of the townsite were evacuated Sunday, May 7, as the fire consumed the surrounding foothills.

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By Wednesday, May 10, the fire had invaded residential areas. Some 400 families would lose their homes before it was over.

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A LAB PREPARED

Some believe it was the special nature of Los Alamos that helped it anticipate and survive a disaster that would have devastated other institutions. Like the unexpected challenges that occasionally arise in scientific work, the ever-changing threats from the fire were met with imagination, courage and competence.

In many ways, the Laboratory was prepared for a wildfire. The Dome Fire had edged close enough to Laboratory property in April 1996 to set in motion a series of forest management and fire-prevention practices aimed at lessening the danger and potential damage from any future fires. By the end of 1999, work crews had removed more than a thousand tons of potential fire fuel from the Lab's vulnerable western and northwestern flanks. It was in these areas where the advance work paid off.

In the heavily wooded Technical Area-16, where the Laboratory conducts extensive high-explosive tests and the Lab's Weapons Engineering Tritium Facility is located, fire-protection crews had removed brush and cut fire breaks. The fire burned over the area doing little damage. Laboratory managers and U.S. Forest Service officials credit this preparatory work in minimizing the damage done to the Laboratory by the Cerro Grande Fire.

AFTERMATH

The response of Los Alamos scientists to the fire's aftermath has been to turn to what they know best — science. And many are contributing to the recovery.

The Multispectral Thermal Imager, a joint project of Los Alamos and Sandia national laboratories and the Savannah River Technology Center and sponsored by the Department of Energy, inaugurated the scientific-data development stage of its three-year mission by providing pictures of the fire-ravaged Los Alamos area for the Laboratory.

The MTI images, scheduled to be shot on a continuing basis as the vegetation returns, will be shared with Laboratory and multi-agency teams to help analyze the burn area, the region's ground cover and current potential flood-mitigation efforts.

In addition to MTI, members of the GENetic Image Exploitation, GENIE, project team at the Laboratory are using GENIE's image processing and analysis technology to analyze aerial and satellite images

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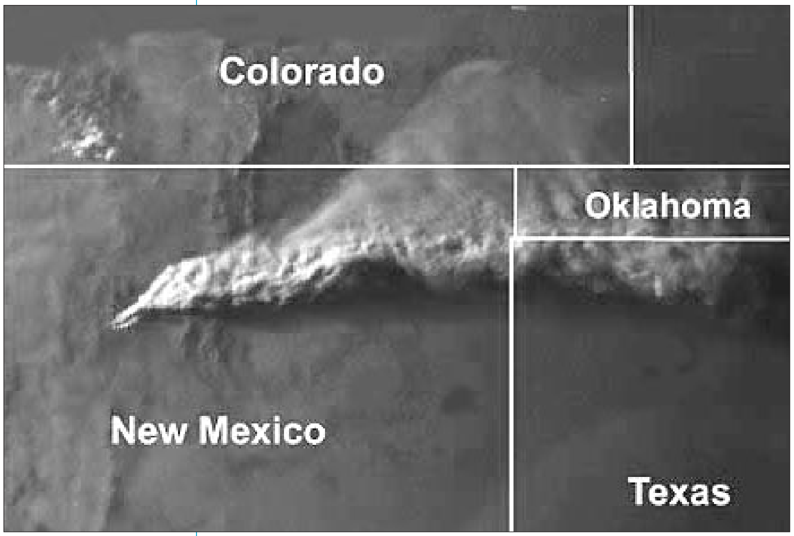
Chief Douglas MacDonald of the Los Alamos Fire Department surveys the damage.

The townsite was off limits to residents and Lab employees, but that didn't stop the media. At times more than 100 members of local, national and international news crews camped out on the smoky hilltop. Here, Laboratory Director John Browne faces reporters at a news conference.

A steel I-beam casts a long shadow across the ruins of a building at S-Site, one of the sites on the western edge of Lab property hit hard by the fire.



The fire was so hot and generated so much smoke that its plume was visible from space.

Satellite image courtesy of the National Oceanic and Atmospheric Administration

of the Los Alamos area to generate high-resolution burn and vegetation maps for the BAER team. The BAER team is a U.S. Forest Service-led Burned Area Emergency Rehabilitation team coordinating environmental restoration for the Cerro Grande Fire.

In another area of the Laboratory, Los Alamos scientists are applying their scientific and technical knowledge toward environmental restoration, using mapping and wildfire modeling technologies. Still other Laboratory researchers are working on better methods to model, plan for and even prevent future disasters like the Cerro Grande Fire. These are just a few examples of the many areas in which science is helping the Lab recover.

It is uncertain when the Laboratory will fully recover from the Cerro Grande Fire. In due time, and with sufficient national support, the buildings and equipment at Los Alamos will be repaired or replaced. With a little help and enough time, even the natural environment will mend.

Meanwhile, scientists have already plunged back into their normal scientific and national security work, and Los Alamos, although a bit charred around the edges, is again ready to fulfill its important national mission.

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Fire crews battled intense flames and thick, choking smoke.

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MITIGATING ANOTHER DISASTER

SUMMER RAINS COULD BRING FLOODING AND EROSION

As if the fire itself was not enough to contend with, Laboratory officials recognized early on that once the fire was put out they would face yet another potential disaster in the form of flooding, significant runoff and erosion. Heavy rainfall, which is normally welcome in a Los Alamos summer, has become a threat to people and property. And it also creates the potential for the movement of legacy contamination off Laboratory property.

Even as the fire burned, the Laboratory was assessing how to deal with these potential threats and collaborating with the Forest Service-led Burned Area Emergency Rehabilitation team to coordinate rehabilitation and flood mitigation efforts. The BAER team focused on mitigation activities on Forest Service and Department of Energy/Laboratory land, while the Laboratory focused on Laboratory assessments and protective actions.

Director John Browne established an Emergency Rehabilitation Team to direct an aggressive program to address potential impacts of increased runoff resulting from the Cerro Grande Fire and look at potential long-term issues arising from the fire.

Protecting employees is the Laboratory's number-one priority. In early June, many employees who work in canyon bottoms were relocated. In addition, employees who continue to work in canyon bottoms are operating under emergency evacuation procedures, in the event of flooding.

A second goal of the ERT is to minimize the potential movement of contamination off Laboratory property. The Laboratory firmly believes there is no human health risk from the movement of contamination, but it is aware that the public is concerned about potential harm to drinking and irrigation water if contaminants move off Laboratory property and into the Rio Grande. In a cooperative agreement with the Laboratory, the U.S. Geological Survey will monitor water quality in the Rio Grande.

The Laboratory has worked aggressively to remove contaminated sediment from Los Alamos Canyon and to build structures such as low-head weirs (low walls that slow the water down and act as sediment traps).

The Laboratory also conducted an extensive evaluation of areas known as "potential release sites" (areas on Lab property that may be contaminated) to see if they were burned in the fire and if they are at risk for erosion. Those deemed at risk for erosion are receiving erosion-control efforts, such as the placement of straw bales, jute matting and rock gabions, which are mesh wire baskets filled with rocks.

During the fire, the public also was concerned about potential releases of contaminants in smoke. Laboratory, New Mexico Environment Department and U.S. Environmental Protection Agency air-sampling efforts all agreed that the increased radiation recorded during the fire was from naturally occurring sources — primarily trees and shrubs — and did not pose any significant added health risk to the public. The increase was due to the burning of radioactive materials left behind from the decay of naturally occurring radon that accumulates on forest vegetation over the course of years.

The third focus is on facilities and infrastructure. Some of the Laboratory's facilities are in canyon bottoms, such as Technical Area 18, where the Laboratory's criticality facility is located. To protect this facility from potential flood and debris flows, the Laboratory is working with the U.S. Army Corps of Engineers to construct a large flood-retention structure upstream in Pajarito Canyon.

Other efforts, including draining and strengthening the Los Alamos reservoir, are taking place to slow down potential storm waters and ensure that facilities and infrastructure, such as power and phone lines, are protected.

Throughout the efforts, the Laboratory has been cooperating with numerous agencies and organizations, including Los Alamos County, the Forest Service and its BAER team. Both on the Laboratory and Forest Service lands above it, massive aerial reseeding and "hydromulching" — the application of a mixture of seeds, mulch, water, fertilizer and a sticky organic tackifier — have taken place. Crews of volunteers and Forest Service workers have raked the slopes surrounding the Laboratory and townsite to break up the soil so that water will be able to penetrate. Severely burned trees that pose a threat either to people or to buildings have been cut down.

The rains to date have caused minor mudslides across roads on the western edge of the Laboratory, but so far the weather is cooperating and crews have been able to install the critical mitigation efforts.

POSTDOCS HIT HARD

YEARS OF RESEARCH LOST

The Physical Chemistry and Applied Spectroscopy Group was probably the hardest hit of any group at the Laboratory by the Cerro Grande Fire. Approximately half of the group's staff lost offices when trailers at the canyon's edge burned.

Within the group, Victor Klimov's small research team focusing on femtosecond spectroscopy and nanochemistry was especially affected. In Klimov's group, four postdoctoral students and a graduate research assistant lost the contents of their offices, sometimes representing years of work.

One postdoc, Jennifer Hollingsworth, lost her entire library of textbooks and nearly two full file drawers of papers, material she had accumulated over the past eight years, including lab logbooks. A

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A plane drops hydromulch over the severely burned hills and steep slopes in Los Alamos. The hydromulch helps keep soil in place and increases the chance that seeds will germinate.

An aerial view of a residential area.

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Volunteer teams from several states have been joined by community volunteers to rehabilitate burned areas.

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Dirt and debris, including large chunks of mud, slid into the road off the burned mountainsides after a storm in late June dropped .79 of an inch of rain.

A charred tree looms over the rubble that once was a postdoc's office.

Potentially contaminated soil is removed from Los Alamos Canyon.

Crews from the U.S. Army Corps of Engineers are building flood-control devices in lower Los Alamos Canyon.

synthetic chemist using colloidal methods to prepare quantum dots, Hollingsworth said the loss of lab notebooks is particularly onerous in her field.

"Synthetic chemistry is a lot like cooking," she said. "As you do experiments, you write little details down in your notebooks about what works and what doesn't. Losing that kind of information can be devastating."

Alexandre Mikhailovski lost notebooks containing 80 percent of his experimental data from the past 18 months, work related to studies of energy relaxation processes and optical properties of semiconductor quantum dots. The lost data included evidence of a discovery used for a patent application. Lost logbooks also contained data affecting a series of experiments conducted in cooperation with external collaborators, that included the Massachusetts Institute of Technology and the University of Rochester.

"My lab notebooks were locked in a drawer in my office along with my computer backups," said Mikhailovski. "I was prepared for computer failure, but not for fire."

THE LAPTOP LAB IN EXILE

SANTA FE INSTITUTE COMES TO THE RESCUE

When the Cerro Grande Fire closed the Laboratory, Los Alamos scientists quickly created what some have called "a laptop lab in exile" at the prestigious Santa Fe Institute. The Institute, a private, non-profit think tank in nearby Santa Fe, provided a home away from home for 10 to 15 Los Alamos researchers during the fire.

The Institute provided computer hardware, software and access to work stations, but many researchers simply brought their own laptop computers. SFI network administrators put these laptops on the Institute's network to establish high-speed computer links with the Lab.

This connection allowed scientists to access the Laboratory's unclassified computers. During the fire the scientists were able to work on their unclassified research and stay in contact with other researchers from the Lab who were scattered across the state.

While working at SFI, researchers were able to continue work in such areas as theoretical biology and quantum mechanics. A scientific seminar originally scheduled for the Laboratory was relocated to SFI.

Perhaps most importantly, SFI gave Los Alamos researchers accustomed to working ceaselessly on their scientific projects a place to work among peers who could offer emotional and intellectual support.

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HISTORY BURNING

TRINITY TEST ASSEMBLY STRUCTURES DESTROYED

In May, while the Cerro Grande Fire was making history, it also was obliterating a part of Laboratory history. Five battered but historic structures where parts of the Trinity atomic bomb were assembled during World War II were destroyed by fire.

The buildings, located in an area once known as V-Site, had recently been named an Official Project of the White House Millennium Council's Save America's Treasures Program. V-Site represented one of the few clusters of buildings from the Manhattan Project era still standing at Los Alamos National Laboratory. The V-Site structures were classic examples of the simply constructed wooden buildings used to usher the world into the nuclear age.

At V-Site, the only structures now remaining are a building called the Trinity Assembly Building and an adjacent utility building. It was in the assembly building that the shaped chunks of conventional high explosives were carefully fitted together in a daylong marathon July 12, 1945, before the device was finally lifted onto a flatbed truck and taken to Trinity Site in southern New Mexico to be mated with nuclear materials. The Trinity Test on July 16, 1945, was the world's first explosion of an atomic device.

The five V-Site buildings consumed by the fire had been constructed by the U.S. Army Corps of Engineers in 1944. None had been used since the 1950s.

Also lost or damaged in the fire were items that had been moved from the primary Trinity device explosives casting building before the building was demolished several years ago. These items included the candy kettles used in the production of the devices high-explosive charges, several light fixtures and specialized plumbing fixtures. The items had been stored in the buildings while awaiting possible shipment to a museum.

The top photo shows the remains of one of the Manhattan Project-era buildings destroyed by the fire. The surviving building in the back is the Trinity Assembly Building. The lower photo shows one of the fire-damaged candy kettles, which was used in the production of high-explosive charges for the Trinity Test device.

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DISCOVERY INCREASES PLANT PRODUCTIVITY BY STIMULATING ITS GROWTH MECHANISM

INCREASING FOOD PRODUCTION WITHOUT INCREASING GREENHOUSE-GAS EMISSIONS

While a rapidly increasing world population is driving science to extend the current limits of world food production technologies, increasing industrialization is making it necessary to mitigate global greenhouse gas emissions. Addressing these two critical issues now seems possible from a discovery emerging from research at Los Alamos. The discovery dramatically increases a plant's productivity by stimulating its own growth regulation mechanism.

Los Alamos scientist Pat Unkefer and her collaborator Tom Knight of the University of Southern Maine discovered a regulatory system in plants that coordinates carbon-dioxide fixation and nitrogen metabolism rates. Unkefer's team is able to stimulate this system to dramatically increase carbon dioxide fixation rates and plant growth rates.

Stimulating carbon dioxide fixation and plant growth would increase production and would sequester the greenhouse gas carbon dioxide as

Cantaloupe plants (on this page) and lettuce plants (on next page) clearly show a dramatic difference in growth rates between the plants that have been treated with the metabolite (on the left) and those untreated (on the right).

well as increase the production of inexpensive biomass for green fuels. Green fuels are environmentally friendly hydrocarbon fuels that contain no lead, but have high-octane ratings, and are made from vegetation and other organic materials

The key to stimulating the plant's regulatory system is a special metabolite that plants produce naturally to monitor their nitrogen supply. This metabolite's function is similar to what happens to a typical lawn after being fertilized with nitrogen. In the fertilized lawn, the added nitrogen allows grass to increase its carbon-dioxide fixation and acquire more mineral nutrients.

As a consequence, the grass grows faster. But adding nitrogen fertilizer can cause only so much increase in plant growth because plant growth is constrained by the plant's internal regulatory system. This system can be overridden by increasing the amount of the plant's special metabolite.

The plant's metabolite was increased by the researchers by either applying a solution of it directly to the plants, preferably their leaves, or by genetically engineering the plant to overproduce this metabolite. Unkefer is careful to point out that the metabolite is neither a pesticide nor a hormone. The engineering approach does not require adding foreign DNA to plants, nor does it alter the plant's normal developmental characteristics such as flowering.

Unkefer first identified the potential for the special metabolite in 1988 and the actual compound itself in 1990, but, like many researchers, she had neither the time nor sufficient funding to pursue the research.

After receiving Laboratory-Directed Research and Development funding and rekindling Knight's interest in the metabolite, Unkefer and Knight began testing the compound she had identified years before. Collaborator Rudy Martinez was recruited and subsequently developed several chemical syntheses, providing the needed supply of metabolite.

By spraying plants with the chemically synthesized version of the metabolite and, later, by forcing certain plants to overproduce the natural form of the metabolite, researchers grew test plants at rates ranging from 40 to 98 percent faster than the controls.

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Rudy Martinez and Pat Unkefer with a batch of their metabolite solution.

Thus far, all of the plant species that have been tested (now more than a dozen) have responded to treatment with the metabolite. Coincidently, plants treated with the metabolite appear to be less attractive to insect pests.

The plant species tested include lettuce, cantaloupe, tomatoes, oats, alfalfa, cotton, switchgrass and tobacco. Tobacco plants have been genetically engineered to overproduce the metabolite. As predicted by the team, these engineered tobacco plants growth much faster, some grow at almost twice the rates of the control plants in the tests.

Unkefer and her collaborators recently filed patents on the use and synthesis of the metabolite. The team is seeking industrial partners to help refine, develop and commercialize the discovery.

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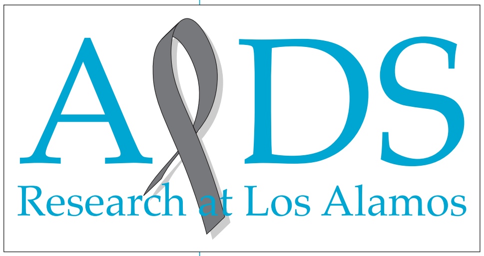
ANCESTOR OF HIV-1 PANDEMIC STRAINS FIRST OCCURRED ABOUT 1930

LOS ALAMOS RESEARCH PUBLISHED IN 'SCIENCE'

Researchers estimate that the most recent common ancestor of the human immunodeficiency virus-1 (HIV-1) strains responsible for the AIDS pandemic occurred about 1930, nearly 30 years earlier than the oldest known HIV-1 positive blood sample.



In a paper published in the June 9 issue of *Science* magazine, Los Alamos theoretical biologist Bette Korber; physicists Tanmoy Bhattacharya, James Theiler, Alan Lapedes and Rajan Gupta; and their colleagues detail how they used advanced phylogenetic tools and genetic models to analyze HIV-1 sequence data compiled at the Los Alamos AIDS and Human Retroviruses Database and estimate the timing of the origins of the strains of HIV that have resulted in the infection of 50 million people. The database is supported by the National Institutes of Health.

"It is important to establish the timing of early events in the AIDS epidemic so that we can begin to examine hypotheses concerning the events surrounding the introduction and spread of HIV in humans," Korber said. "It's also helpful to understand the speed with which the virus accumulates mutations so that we can better understand what it will take to design successful vaccines."

HIV is considered to be the result of chimpanzee-to-human transmission because it is most closely related to a group of simian immunodeficiency viruses (SIVs) found in chimpanzees that have a geographic range in West Equatorial Africa. Current evidence suggests that the HIV-1 M group, the main group of viruses, is likely to have resulted from one of those transmission events. Previous efforts to date the most recent common ancestor of the M group have yielded less accurate results because they were based on fewer HIV-1 sequences and used less refined evolutionary models.

In the recent study, Bhattacharya and Theiler produced a computer code that provided improved evolutionary models and a statistical analysis. Los Alamos' Nirvana supercomputer was used for generating the computationally intensive phylogenetic trees, and a maximum

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likelihood method was developed for correlating distances between branches in a genetic tree to the passage of time.

Using HIV sequences sampled in the last two decades, Korber created the phylogenetic trees that organized the sequences according to their genetic relatedness by using an evolutionary model that incorporates some of the peculiarities of HIV evolution. This tree was then used as a basis to extrapolate back to the most recent common ancestor.

The length of the branches in the immense tree represented the extent of genetic change between HIVs; more closely related viruses are associated and have shorter branches separating them, more distantly related viruses have long branches. The branching patterns were based on calculations performed with the supercomputer, beginning with a comprehensive set of HIV sequences with known dates of sampling.

The researchers then worked backward to estimate the most likely model to describe the data. The rate of evolution determined using this tree — as well as a biologically motivated model for considering error in both time and genetic distance — allowed the researchers to determine the time of the ancestral sequence to be within the first half of the 20th century.

The phylogenetic tree for HIV was calculated using maximum likelihood methods. These are considered among the best methods for answering statistical questions of this kind, but require large amounts of computational resources. Because the researchers used Nirvana, the fastest unclassified supercomputer in the world, they were able to process vast numbers of candidate phylogenies relatively quickly and with considerable accuracy and to statistically analyze their evolutionary model.

To calculate the time of origin, the researchers used strategies that permitted them either to assume a constant rate of evolution or to factor in a changing rate. The researchers also tested their methodology by using it to estimate the timing of two historically documented points in the HIV family tree — the sampling time of the oldest available HIV sequence (1959) and the origin of the epidemic in Thailand (near 1986). The Los Alamos method estimated these events accurately, enhancing confidence in the results.

The research was funded through Los Alamos' Laboratory-Directed Research and Development program, the National Institutes of Health and the Pediatric AIDS Foundation.

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TEST DEMONSTRATES WEAPON IN-FLIGHT PERFORMANCE SYSTEM

HIGH-EXPLOSIVE RADIO TELEMETRY SYSTEM

Researchers have performed ground and flight tests on an instrument system that can transmit mock nuclear weapon performance data until the point of detonation. The new telemetry system will aid in the assessment of the engineering and physics performance of nuclear warheads during flight conditions. Such assessments are necessary because even the most thorough ground testing and simulation of a missile can fail to detect in-flight conditions that might adversely affect the performance of the warhead after launch.

The heart of this instrument package is HERT, the High-Explosive Radio Telemetry System, which transmits a variety of data during the missile's flight as well as performance data from the weapon's high-explosive component as it detonates. Such data can help those monitoring the weapon from a control center determine whether systems inside the weapon are functioning properly, and detect changes in vibration, temperature, acceleration and other variables during flight.

← A new telemetry system can assess the performance of a warhead from launch to detonation.

Department of Defense Photo

Researchers are collaborating on a new-generation HERT system that can transmit data in high-shock and low-shock environments, improving the reliability and reporting capability of the system. Using advanced manufacturing techniques and cutting-edge components, scientists aim to make HERT Mark II smaller and lighter than earlier designs.

In March, a research team from Los Alamos, Lawrence Livermore and Sandia national laboratories and the Department of Energy's Kansas City Plant tested HERT Mark in a Lawrence Livermore re-entry vehicle flown from Vandenberg Air Force Base in California to Kwajalein Island in the South Pacific. The system collected data successfully.

Before the recent flight test, researchers had tested HERT systems in an explosive environment. The team was able to collect and analyze data successfully from a series of explosive tests, lending further credibility to the systems' potential.

Los Alamos is focusing on HERT instrumentation for the W76 submarine-launched missile system. Researchers from Los Alamos, Lawrence Livermore, Kansas City and Sandia also will use HERT on other weapons systems in the stockpile. Funding for HERT research and development comes from DOE Defense Programs.

HERT units will become essential tools for evaluating the performance of the nation's stockpile by using mock nuclear components in actual flight conditions. This testing will help ensure the safety, reliability and performance of U.S. nuclear weapons.

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10TH SUPERCOMPUTING CHALLENGE

SANDIA PREPARATORY SCHOOL TEAM TAKES TOP PRIZE

A computer analysis of sorted cell data gave a computer team from Sandia Preparatory School in Albuquerque the top prize in the 10th annual New Mexico High School Supercomputing Challenge at Los Alamos.

Students Carli McGee, Heather Wood and Joan Goldsworthy took home a $1,000 savings bond each for their supercomputer program "Pattern Analysis of High Throughput Flow Cytometry Data." Their teachers received a computer loaded with software for their classroom.

Albuquerque Sandia Preparatory School teacher Neil McBeth, right, shares a laugh with (from left to right) students Joan Goldsworthy, Carli McGee and Heather Wood and teacher Jori Bowen during the awards ceremony at the 10th New Mexico High School Supercomputing Challenge. The Sandia Prep team took the prize in this year's challenge for its project, "Pattern Analysis of High Throughput Flow Cytometry Data."

Nearly 350 students competed in the Challenge. Fifty teams, including 11 finalist teams, heard talks from researchers at Los Alamos and toured the supercomputers they used during the Challenge.

Students from 41 schools spent the last year researching scientific problems and writing programs to solve them on computers at Los Alamos and Sandia national laboratories. About $36,000 in scholarships were awarded at this year's Challenge.

The goal of the Supercomputing Challenge is to increase knowledge of science and computing, expose students and teachers to computers and applied mathematics, and instill enthusiasm for science in high school students, their families and communities.

Any New Mexico high school student in grades 9 through 12 can enter the Challenge.

The New Mexico High School Supercomputing Challenge is unique because it offers supercomputer access to students at every level of expertise and stresses student activity over work by teachers and coaches.

Many of the final reports of teams finishing the Challenge can be viewed on the Web at http://www.challenge.nm.org.

The Supercomputing Challenge was conceived in 1990 by former Los Alamos Director Sig Hecker and Tom Thornhill, president of New Mexico Technet Inc., a non-profit company that in 1985 set up a computer network to link the state's national laboratories, universities, state government and some private companies. U.S. Sen. Pete Domenici, R-N.M., and John Rollwagen, then chairman and chief executive officer of Cray Research Inc., added their support.

The Supercomputing Challenge is sponsored by Los Alamos and New Mexico Technet Inc. Benefactors include CISCO Systems Inc., DP Signal, Intel Corp., Kinko's and Microsoft Corp.

Patrons include Sandia National Laboratories, University of New Mexico, New Mexico State University, New Mexico Institute of Mining and Technology, Albuquerque Tribune, SGI, Council for High Education Computing Services, Eastern New Mexico University, New Mexico Highlands University, New Mexico Department of Education, San Juan College, Santa Fe Community College, Belew's Office Supply, Dean Gianopoulus Design and Miller Bonded.

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PEOPLE IN THE NEWS

BIOPHYSICIST WINS PRESIDENTIAL EARLY CAREER AWARD

Xian Chen, a biophysicist in the Chemical Science and Technology Division, has received the Presidential Early Career Award from the National Science and Technology Council, a cabinet-level agency that coordinates federal research and development in science, technology and space.


Xian Chen

The Presidential Early Career Award is the highest honor given to young scientists and engineers by the U.S. government. It recognizes those who show exceptional potential for science excellence and leadership in their respective fields. Winning researchers also receive funding for their research for five years.

Chen received his bachelor's degree in chemistry from Peking (now Beijing) University in 1985. He received his doctorate in organic chemistry from Penn State University in 1991. Chen then worked as a postdoctoral associate at the University of Florida Medical School before being named a postdoctoral fellow at Los Alamos in November 1993. He now is a staff member in the Analytical Chemistry Sciences Group.

Chen's current research focuses on functional genomics, how genes function and interact with each other, an integral component of the Human Genome Project. Chen is involved in developing new analytical methods using biological mass spectrometry for determining gene products and their functions. He also is one of the initiators of Los Alamos' Biological Mass Spectrometry Program.

He has patents pending on three new analytical techniques, including a method of stable-isotope-assisted mass spectrometry that verifies DNA sequencing data, detects genetic variations within the human genome and helps researchers identify massive gene products. He also has authored or co-authored more than 20 scientific papers.

Chen is a member of the American Chemical Society, American Society for Mass Spectrometry and Biophysical Society.

DATELINE: LOS ALAMOS

SCIENCE FOR THE 21ST CENTURY

HEAT PIPES

AN IDEA BORROWED FROM ENGLISH BAKERS FINDS USE IN FUTURE SPACE-AGE TRAVEL

Heat pipes are pencil-sized metal tubes that move heat from one end of the tube to the other without the aid of a pump. Within the heat pipe, heat vaporizes a small amount of fluid at the pipe's hot end, the fluid travels to the other, slightly cooler end and condenses before returning to the hot end through a capillary wick, where it repeats the process. The device efficiently transfers large quantities of heat.

Being studied for future space-age travel, heat-pipe technology was borrowed from rudimentary heat-conducting pipes used by English bakers 100 years ago.

Heat pipes vary greatly in size, depending upon their particular use. Some are the size of hypodermic needles, while larger versions stretch to 24 feet. Modern applications of this technology include miniature heat pipes that cool the chips inside most laptop computers.

Heat pipes work efficiently in a zero-gravity environment; commercially developed heat pipes are now routinely used to cool electronics in communications satellites.

Modern heat pipe technology was first developed at Los Alamos

Inventor George Grover tests an early heat pipe in this photo taken in the 1960s.

nearly 40 years ago. George Grover, who did much of the pioneering and theoretical work on heat pipes at Los Alamos, demonstrated the first heat pipe in 1963.

Early Los Alamos heat pipes contained water or sodium. Now they often use lithium, a soft silver-white chemical element that is the lightest known metal. When placed inside a molybdenum pipe, which can operate at white-hot temperatures approaching 2,200 degrees Fahrenheit, the lithium vaporizes and carries heat down the length of the pipe.

A lithium heat pipe developed at Los Alamos in the mid-1980s transferred heat energy at a power density of 23 kilowatts per square centimeter. To put this figure in perspective, heat is emitted from the sun's surface at six kilowatts per square centimeter.

In 1996, three Los Alamos heat pipes, prototypes of liquid-metal heat pipes to be used in advanced spacecraft, were flown and tested aboard the space shuttle Endeavor. The pipes operated at temperatures exceeding 900 degrees Fahrenheit and performed flawlessly.

Today Los Alamos is working with NASA's Marshall Space Flight Center in Huntsville, Ala., to develop heat pipes for use in generating electricity and propelling spacecraft journeying to the solar system's outer limits.

Los Alamos researchers are developing heat pipes for other applications as well as they take their research to the next level and are interacting with potential collaborators on problems that can be solved using this technology.

Scientists recently worked with NASA Langley Research Center in Hampton, Va., in the design of a futuristic hypersonic aerospace plane, a 10,000-mile-an-hour aircraft that would take off from a runway like a jet, but then complete most of its flight in low-Earth orbit.

Heat pipes cooling the leading edges of the wings and engine ducts of such a plane could open the door to two-hour New York-to-Tokyo flights.

SUMMER ISSUE 2000

DATELINE: LOS ALAMOS

Worried residents of Los Alamos watch from a North Mesa residential area as the Cerro Grande Fire burns across the mountainside and moves closer to the townsite. Los Alamos and the neighboring bedroom community of White Rock were evacuated and the Laboratory closed during the wildfire that eventually consumed almost 50,000 acres of New Mexico. The fire and its impact on the Laboratory are featured in this month's issue of Dateline: Los Alamos.

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