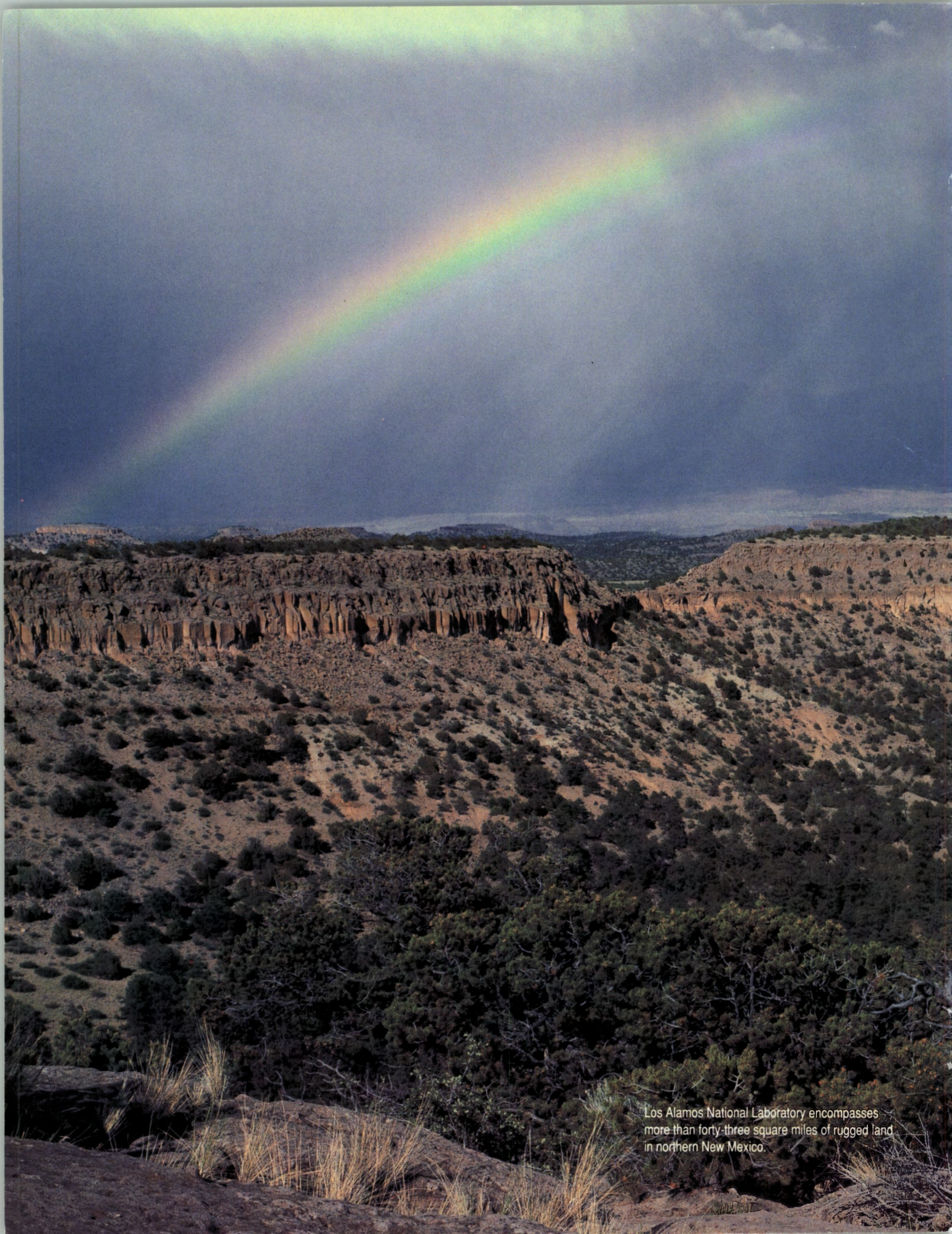
LOS ALAMOS
NATIONAL
LABORATORY

A National Resource

9527



Los Alamos National Laboratory encompasses more than forty-three square miles of rugged land in northern New Mexico.

THE SCIENCE OF CHALLENGE AND DISCOVERY 1

The Laboratory's First Challenge 3

Los Alamos Today 5

FULFILLING OUR MISSION 7

Nuclear Weapons Technology 9

Nonnuclear Defense Technology 13

Energy and Technology 17

Chemistry and Materials Research 21

Basic Research 25

INTERDISCIPLINARY RESEARCH CENTERS AND RESOURCES FOR CREATIVE THINKING 29

EDUCATIONAL AND EMPLOYMENT OPPORTUNITIES 35

Professional Development and Benefits 37

Special Employment Programs and Opportunities 37

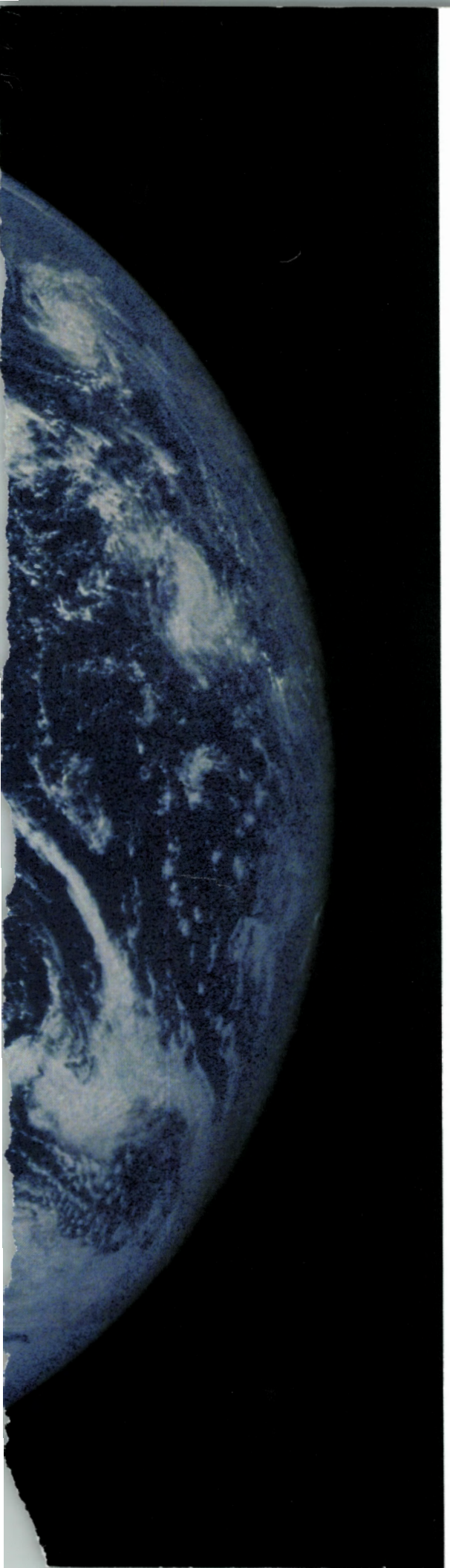
SCIENCE IN A NATURAL SETTING 39

The Community 43

Schools 43

Attractions and Special Events 45

CHALLENGE AND DISCOVERY IN THE FUTURE 49

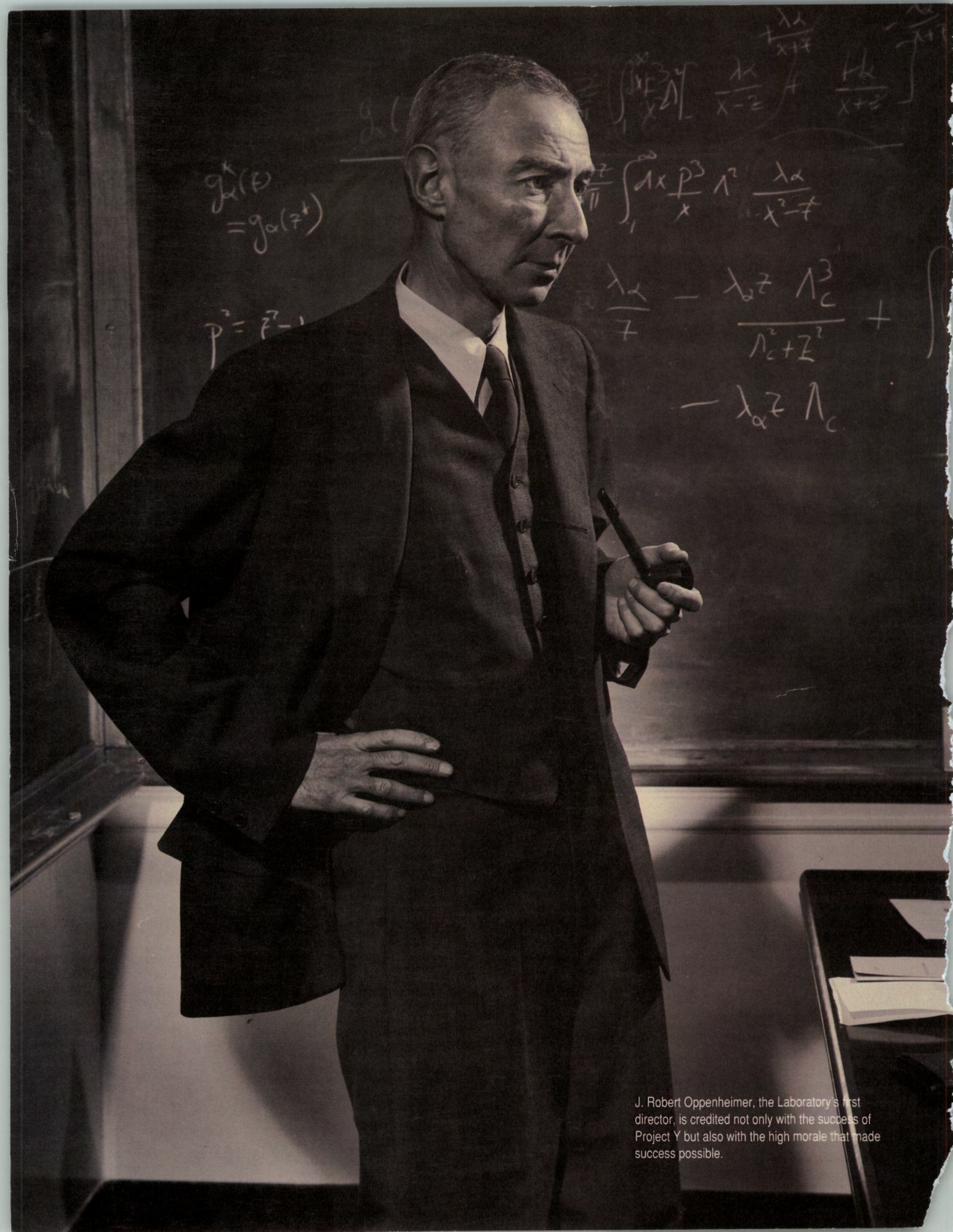


The Science of Challenge and Discovery

At Los Alamos National Laboratory, we investigate a multitude of phenomena that extend from the earth's interior through its atmosphere and magnetosphere into outer space, from subnuclear particles to galaxies, from events occurring in trillionths of a second to those that take thousands of centuries, and from temperatures near absolute zero to those measured in tens of millions of degrees.

Our mission is to apply science and engineering capabilities to problems of national security. This mission has expanded from the charge to design nuclear weapons—still the primary task—to include nonnuclear defense programs and a broad array of nondefense programs. We conduct extensive research in energy, nuclear safeguards and security, biomedical science, computational science, environmental protection and cleanup, materials science, and other basic sciences. In staff and technical capabilities, Los Alamos is one of the largest multidisciplinary, multiprogram laboratories in the world.

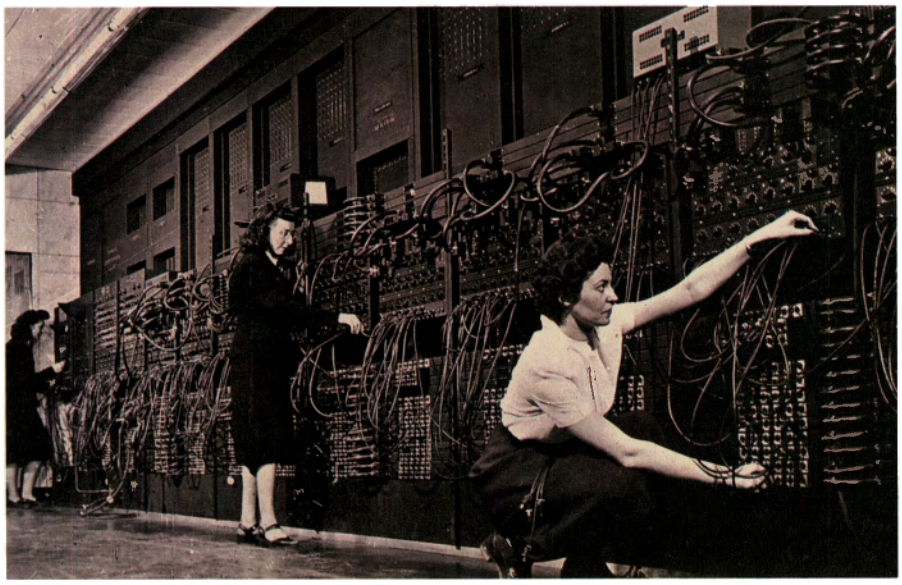
For those of us who live and work here, Los Alamos offers challenge and discovery in a setting of great natural beauty. We welcome you to Los Alamos.



J. Robert Oppenheimer, the Laboratory's first director, is credited not only with the success of Project Y but also with the high morale that made success possible.

In the early years, Los Alamos was a temporary town of haphazard buildings that resembled a frontier mining camp.

Los Alamos residents had to pass through two guard stations to get in or out of town. In what was probably the most secret project ever undertaken by the United States, secrecy became a way of life.



The Laboratory's first supercomputer was the MANIAC (mathematical analyzer, numerical integrator, and computer), which was designed and built by Los Alamos. The first large-scale calculation, a problem in hydrodynamics, was run on the MANIAC in 1952.

A crew prepares for the trial run at Trinity in southern New Mexico on May 7, 1945. This explosion of 100 tons of TNT would have been an unforgettable sight had it not been outdone so soon afterward by the nuclear explosion on July 16.

The Laboratory's First Challenge

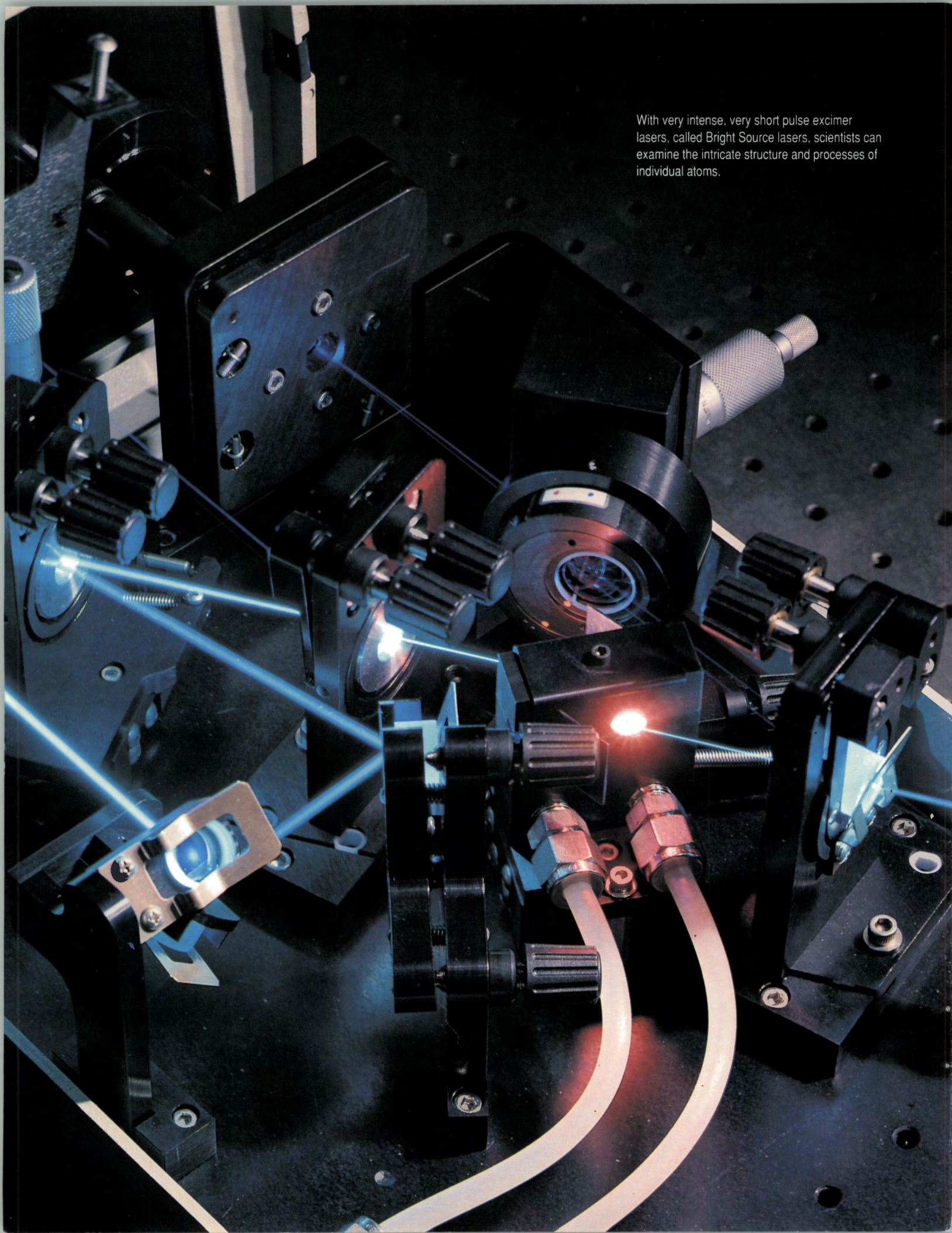
In March 1943, a small group of scientists came to a remote mesa high above the Rio Grande, northwest of Santa Fe. Their mission was to design and build the world's first nuclear weapon. This challenge, called Project Y, was part of the U.S. Army's secret World War II crash program to develop and produce a weapon that would unleash the huge amounts of energy produced during nuclear fission.

Although radioactivity had been known since 1896, nuclear fission was not discovered until 1938. Immediately thereafter, scientists all over the world began investigating fission and the possibility of a chain reaction that would release useful amounts of nuclear energy.

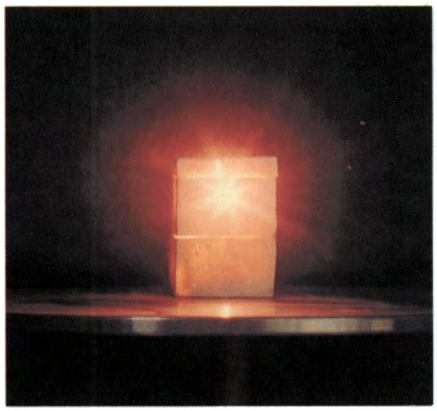
The results of these investigations and the early recognition that uranium fission had military applications led a group of American scientists, including several refugees from Nazi Germany, to write to President Franklin Roosevelt. They persuaded him to support a uranium research program to investigate nuclear power and nuclear weapons.

The United States' entry into World War II in 1941 and the belief that the Germans were working on an atomic bomb spurred the expansion of this research program into the massive Manhattan Project, a wartime effort carried out with the utmost secrecy and urgency by the finest scientific and engineering talent available.

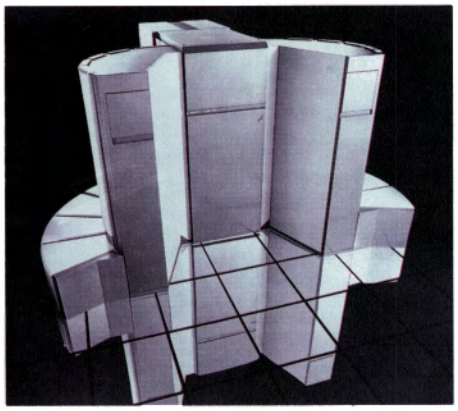
Experimental work on nuclear fission culminated at the University of Chicago on December 2, 1942, when Enrico Fermi and his coworkers achieved the world's first nuclear chain reaction. Meanwhile, J. Robert Oppenheimer and a small group of well-known physicists at the University of California, Berkeley, were investigating theoretical possibilities for an atomic bomb. By late 1942, their studies had progressed so that experimentation in a laboratory was necessary.



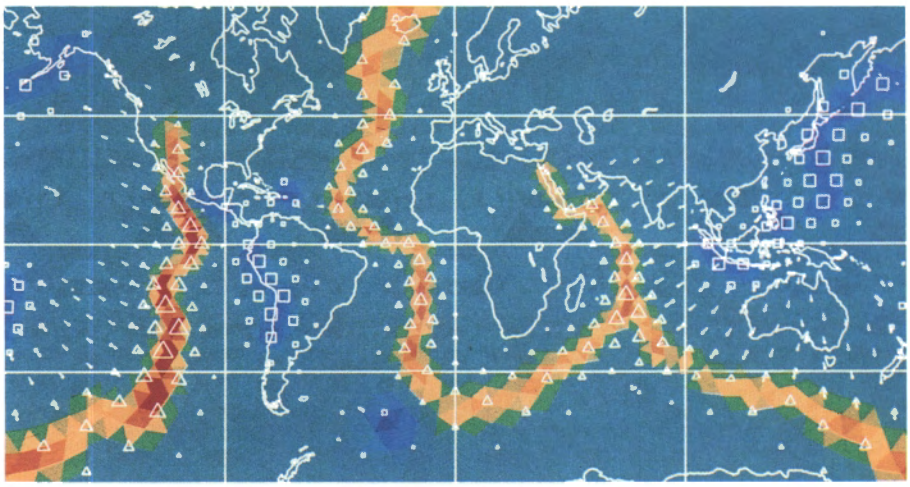
With very intense, very short pulse excimer lasers, called Bright Source lasers, scientists can examine the intricate structure and processes of individual atoms.



Los Alamos has made major contributions to materials processing research and maintains extensive state-of-the-art facilities. Here, a sample of boron carbide is rapidly sintered in a microwave oven to produce a fine-grained ceramic.

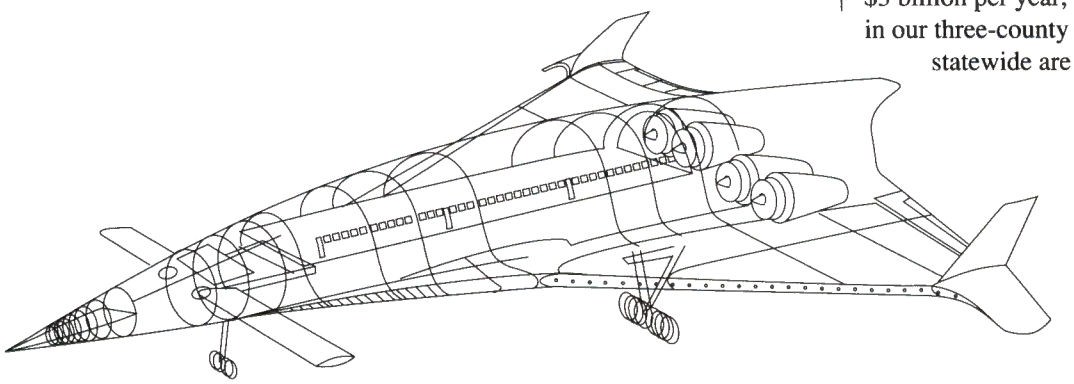


Los Alamos continues to lead the world in computational science. Two CRAY Y-MP computers, recently installed, have increased the supercomputing power of the Laboratory's main computer network to the equivalent of about sixty-five CRAY-1 computers.



This computer image shows reddish orange areas where heat is rising from the earth's mantle. Such models of heat transfer from the interior of the earth help us understand some of the complex forces that build mountains and cause earthquakes and volcanoes.

We are studying the unique supersonic combustion requirements of the National Aerospace Plane.



Several sites in the western United States were surveyed as possible locations for the new laboratory. Los Alamos was chosen because it offered isolation, a good climate, a sparse population, nearby government-owned land that could be easily acquired, and existing housing at Los Alamos Ranch School.

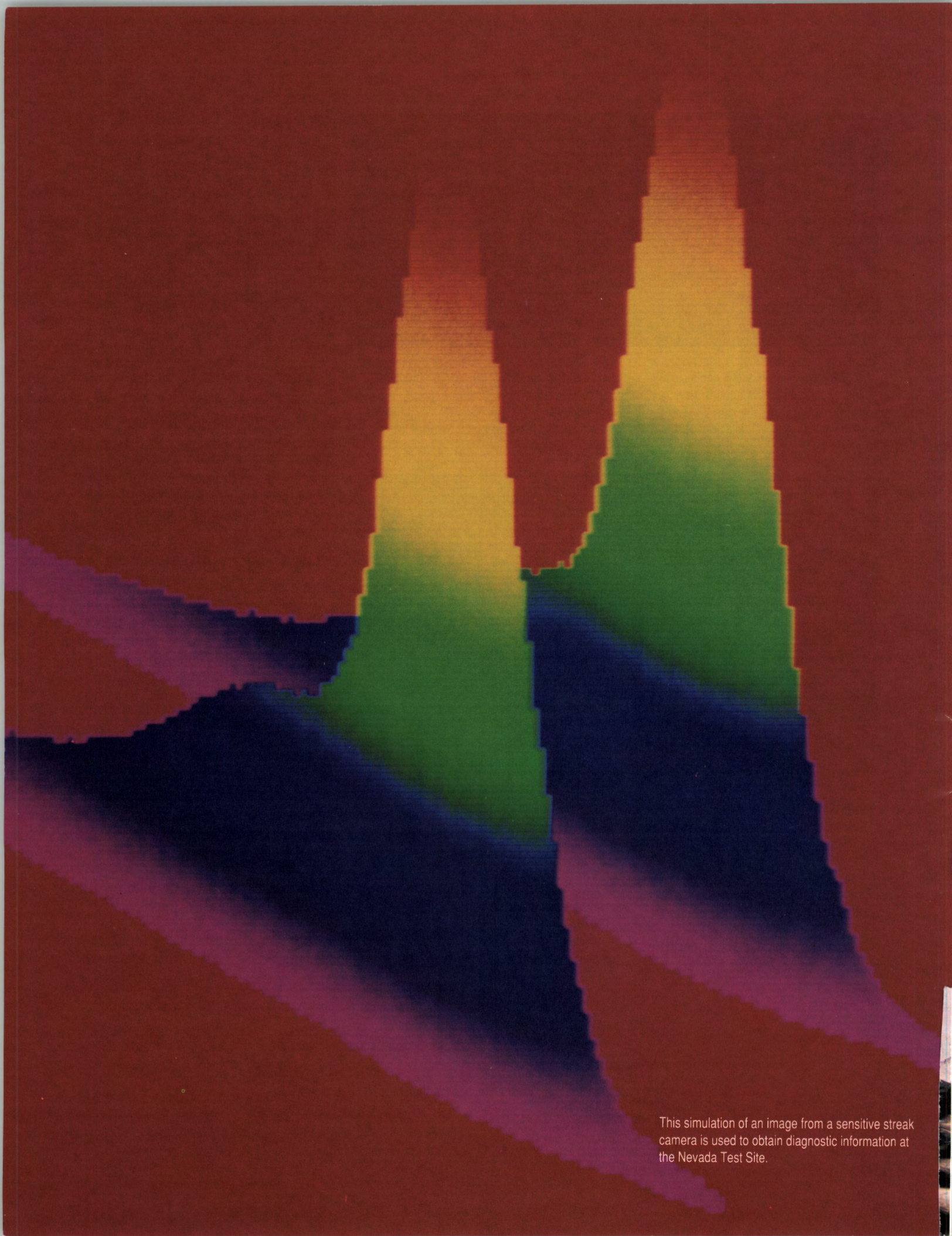
Originally, Oppenheimer believed that one hundred scientists would be needed to develop the weapon. But more than three thousand civilian and military personnel were working at Los Alamos in July 1945, when the first nuclear test was successfully performed at Trinity Site in southern New Mexico.

After the end of World War II, Los Alamos became a permanent institution that has achieved recognition as one of the finest scientific research laboratories in the world.

Los Alamos Today

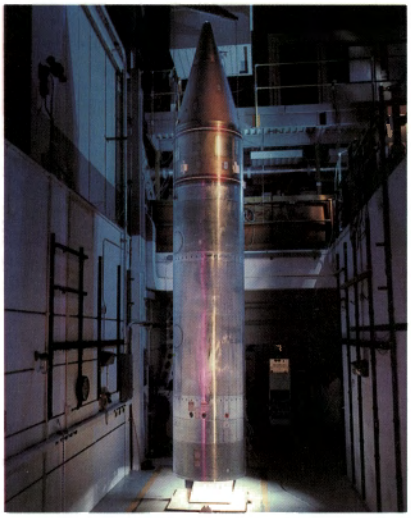
Today the Laboratory is a multiprogram national laboratory of the U.S. Department of Energy, operated by the University of California. The Laboratory encompasses more than forty-three square miles of mesas and canyons in northern New Mexico. The largest institution in the area, it has an annual budget of about $1 billion and about seventy-six hundred regular full-time employees.

For four decades Los Alamos has positively influenced the local community by offering steady employment, creating a market for goods and services, and providing Laboratory resources to local educators. Our impact on the economy of northern New Mexico is estimated at $3 billion per year; 38 percent of the jobs in our three-county area and 5 percent statewide are Laboratory related.

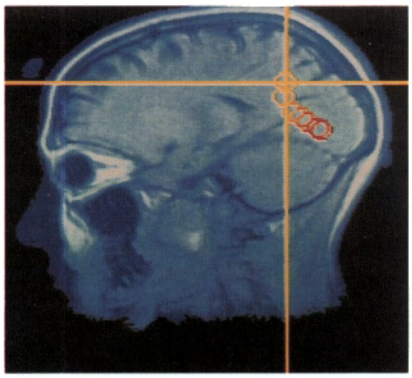


This simulation of an image from a sensitive streak camera is used to obtain diagnostic information at the Nevada Test Site.

FULFILLING OUR MISSION



On July 13, 1989, the Beam Experiments Aboard a Rocket (BEAR) payload successfully fired hundreds of neutral particle beams in space, lending support to the belief that a space-based missile defense system may someday be feasible.



The focus of our neurobiological research is on neural processing. The general goal is to understand how signals such as light and sound are transformed by integrated systems of neurons in the brain. Projects include studies of the auditory processing of human speech and studies of the effects of drugs used to treat psychiatric disorders and drug abuse.

The Laboratory's primary mission—ensuring the nation's security through nuclear weapons technology—depends on an outstanding science and technology base. To succeed in our primary mission and to be responsive to the broader mission of national security, which requires a strong defense, economic strength, and energy security, we conduct many programs that complement the primary mission. And, we encourage new ideas that fit the long-term vision of a multidisciplinary laboratory.

Most Laboratory research is a mix of academic disciplines that stimulate the creative thinking needed to meet today's scientific challenges. We pursue work in five major areas: nuclear weapons technology, nonnuclear defense technology, energy and related technologies, chemistry and materials, and basic science. This work has a tremendous effect on how we live—and how we hope to live in the future.

The Nevada Test Site is the location of all present U.S. underground nuclear weapons tests. In preparation for another underground test, this typical diagnostics rack will be lowered into a bore hole.

Earth-penetrating nuclear warheads represent new possibilities in weapons systems. This particular warhead penetrated a foot of concrete and came to rest almost nine feet below the top surface. In subsequent tests, an improved warhead penetrated the concrete completely.

The U.S. and Soviet flags flying from a derrick at the Nevada Test Site symbolize the milestone reached when scientists of both countries participated in joint experiments to verify treaty compliance.

Nuclear Weapons Technology

For almost fifty years, Los Alamos has pursued basic and applied research and technology development to support the nation's nuclear deterrent. Our earliest contributions—the world's first nuclear explosives—speeded the end of World War II.

Developing nuclear weapons continues to be a complex technical challenge. The physical conditions during a nuclear explosion go far beyond what can be easily duplicated in an ordinary laboratory or simulated by computers. They involve materials, in some cases exotic materials, exposed to temperatures hotter than the interior of stars and responding to pressures greater than many million atmospheres (an atmosphere equals 14.6 pounds per square inch). Scientists and engineers from many disciplines are required, and their tasks range from basic understanding and theoretical modeling to materials and engineering development, prototype fabrication, and diagnostics testing.

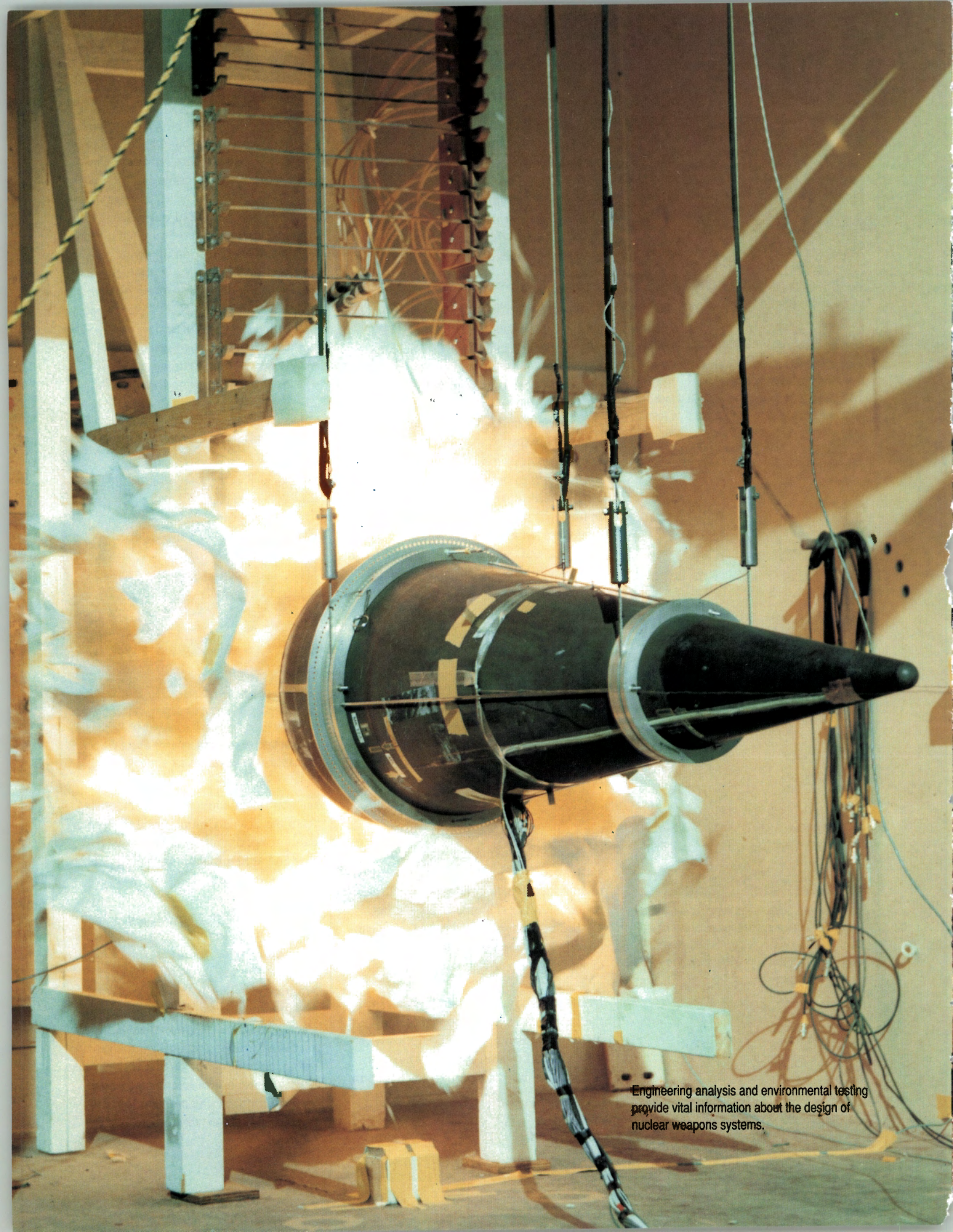
The primary goals of our weapons program are to develop and maintain safe, secure, reliable, and credible nuclear weapons for the U.S. nuclear deterrent forces and to explore new concepts and basic technologies so that we are responsive to changes in national security requirements and avoid technological surprises. Our responsibilities span the research-to-retirement phases of nuclear weapons. We maintain a highly qualified staff, specialized laboratories, and experimental facilities to conduct this complex research and development. By the late 1980s, more than 60 percent of the weapons in the nation's nuclear stockpile were designed by Los Alamos.

Underground nuclear testing is an essential part of nuclear weapons development. This testing, which complies with international treaties, provides most of the data on weapons performance and, in some cases, weapons effects. Knowledge gained from underground testing is critical to maintaining our competence in nuclear weapons technology.

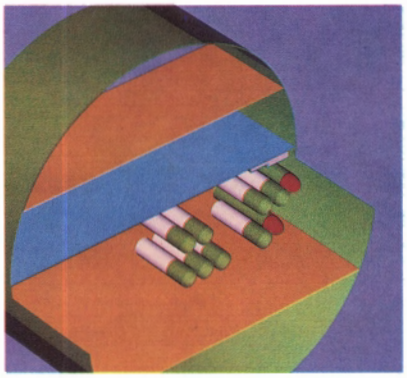
A significant feature of our nuclear technology program is providing technology options for verification of arms control treaties and nuclear testing agreements. A compact system developed by Los Alamos, called CORRTEX, can reliably determine the yield of underground nuclear explosions by measuring the shock waves from detonations. This system was used during two historic nuclear tests conducted with scientists from the Soviet Union: the Joint Verification Experiments at the Nevada Test Site and at Semipalatinsk, the Soviet Union test site.

This image from a neutron pinhole camera, which is similar to that obtained during an underground nuclear test, gives us information about the performance of a nuclear device.

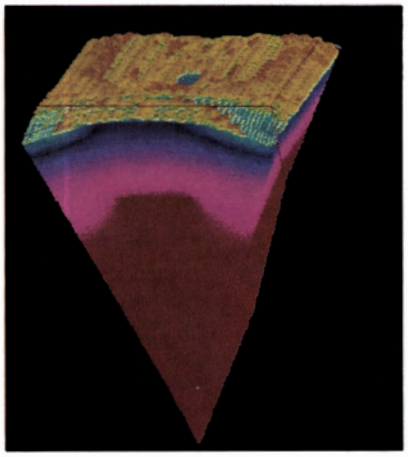
We established the Arms Control Technology Office to focus the Laboratory's technical support for arms control negotiations. The verification technology program provides technical, analytical, and other support to the Department of Energy. The office's activities include assessing foreign technology and developing technology for on-site inspections. If new arms control treaties are negotiated and ratified, the demand for additional verification technologies may increase.



Engineering analysis and environmental testing provide vital information about the design of nuclear weapons systems.



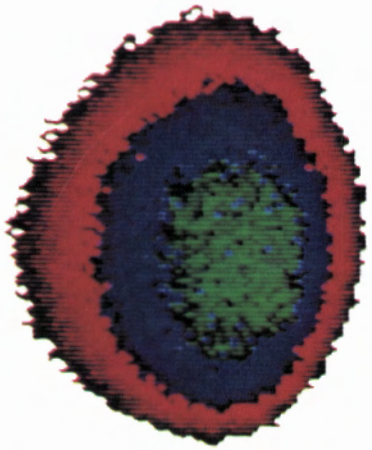
This computer simulation shows a possible configuration of nuclear and conventional weapons stored aboard a submarine. Researchers use these simulations to optimize storage locations and radiation shielding for the nuclear weapons so as to provide a safe environment for crew members.



We continue to develop extensive computer simulation and design codes to support our weapons programs. Computer simulations are less expensive than actual tests and provide information not directly observable in experiments.

Nuclear weapons require special materials—in some cases expensive materials and in other cases materials that produce hazardous waste during fabrication. Los Alamos has extensive experience and resources to apply to research, development, and demonstration of technologies used in the processing and manufacturing of nuclear materials. These efforts are supported by programs in materials measurement, safety, radiation protection, waste management, and environmental protection and restoration.

The Department of Energy has established aggressive programs for environmental restoration and modernization of manufacturing methods at the nuclear weapons complex. We have unique capabilities and research ideas that can be used to reduce the cost of these programs and assure their quality. Recently we established a program office to coordinate and focus our efforts to support the modernization program. One important contribution is the development at Los Alamos of processing technologies for special nuclear materials that minimize hazardous waste products and reduce worker radiation exposure.



We are attempting to duplicate the thermonuclear processes of the stars with our high-power Aurora laser system. This x-ray image of an imploded fusion target gives us information about the physical processes that occur in laser-target interaction experiments.

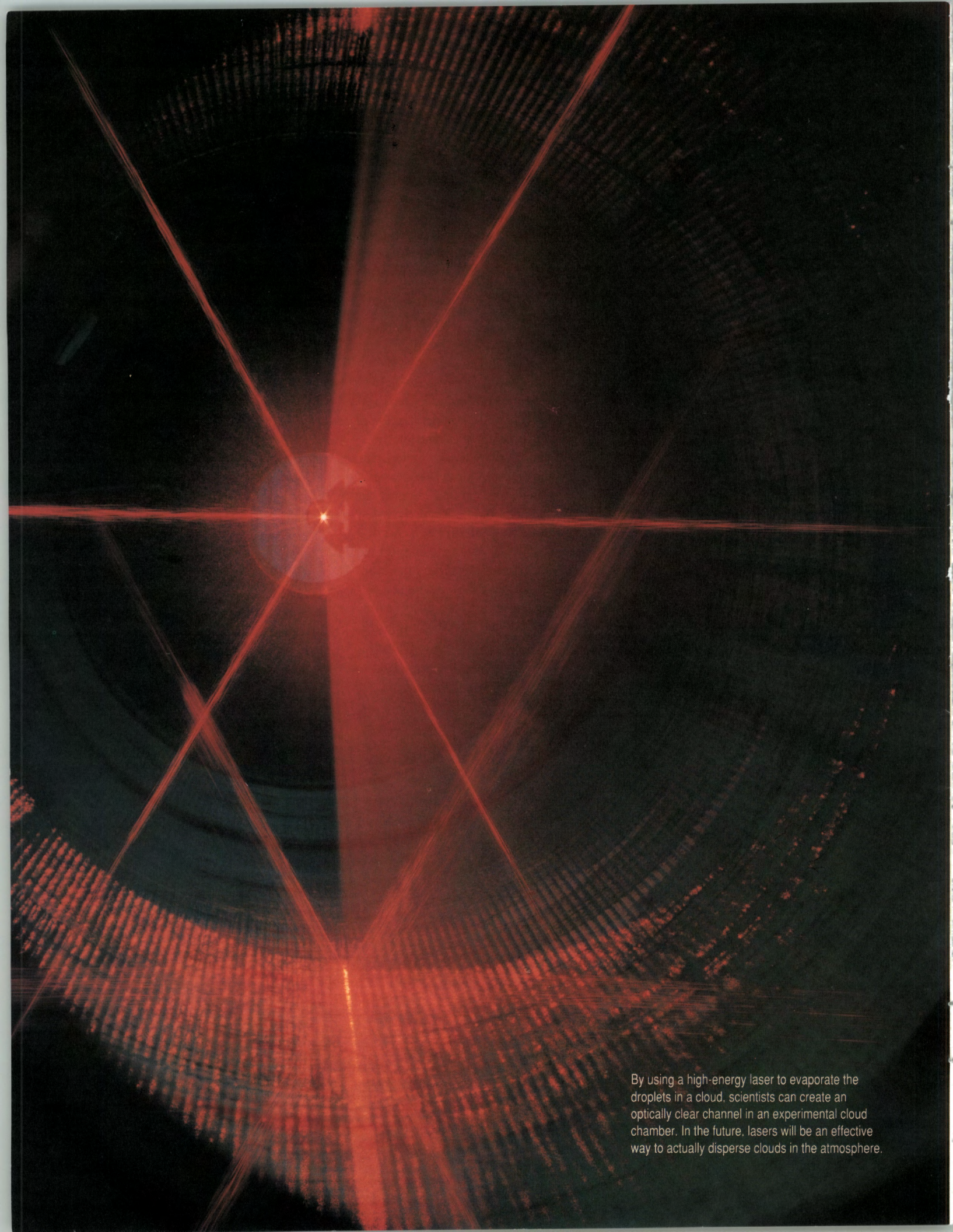
As part of a national safeguards and security effort, we are exploring methods to provide computer system security and investigating advanced accounting technology for nuclear materials. We work with the international safeguards program to help ensure that nuclear materials and resources intended for peaceful use are not diverted for improper purposes.

To support our weapons program, we continue to develop extensive computer simulation and design codes. Advanced computational approaches can provide insights into phenomena not directly observable in experiments. With the increasing cost of tests and with the possibility of additional arms control agreements, the role of computational simulations is becoming more and more important.

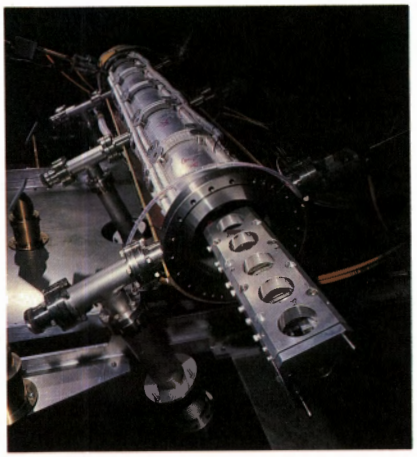
Our research in inertial confinement fusion (the thermonuclear fusion of light isotopes of hydrogen with the attendant release of energy) is of potential value to the weapons program. We use powerful lasers to provide the initiating conditions to produce controlled fusion in the laboratory, and we may also deduce information about some of the physics processes in nuclear weapons. An ultimate objective is to determine if inertial fusion can be used to produce economical electric power on a commercial scale.

Accomplishing inertial confinement fusion in the laboratory requires high-energy beams. We are concentrating on the Aurora system, a short-pulse, high-power krypton fluoride laser that is the world's first prototype for demonstrating the complete technology of large-scale ultraviolet laser systems.

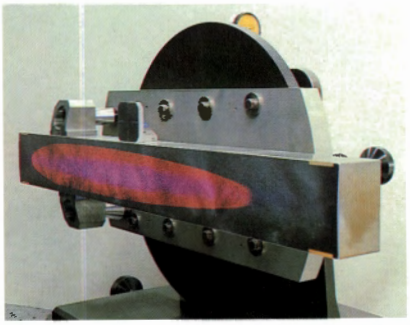
Benefits of the nuclear weapons program extend well beyond the national security mission. This program provides scientific expertise and specialized resources that contribute to many other important national programs.



By using a high-energy laser to evaporate the droplets in a cloud, scientists can create an optically clear channel in an experimental cloud chamber. In the future, lasers will be an effective way to actually disperse clouds in the atmosphere.



The free-electron laser generates light by converting part of an electron beam's energy into light. By properly arranging an array of magnets called a wiggler, through which the electron beam is passed, we can tune the light to almost any wavelength—a feature that makes this laser extremely versatile.



Grazing reflections, which allow the intense beam of a free-electron laser to be redirected (by merely grazing the mirror), prevent damage to the optical surface of the mirror.

Nonnuclear Defense Technology

Although the Laboratory's primary mission remains the application of science and engineering technology to ensure the nation's nuclear deterrent, we devote almost one-fourth of our effort to nonnuclear defense programs funded by the Department of Defense. This research includes efforts in directed-energy weapons, defensive lasers, and conventional defense.

In the area of directed-energy weapons, we are investigating the use of neutral particle beams (NPBs) for the Strategic Defense Initiative. A recent test called BEAR (Beam Experiments Aboard a Rocket) successfully fired the world's first neutral particle beam in space. Although Los Alamos was responsible for the technical direction of BEAR, the project was a team effort with several industrial contractors.

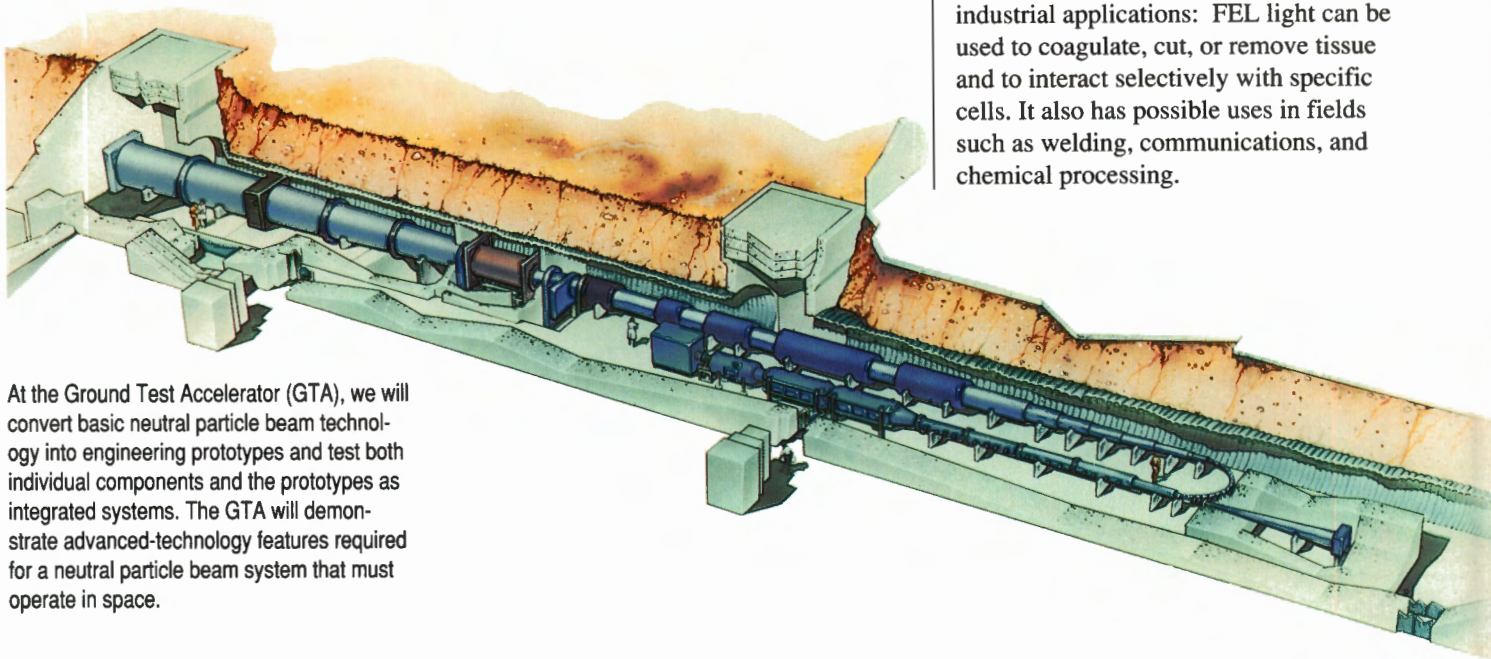
Another major activity in our NPB development program is the Ground Test Accelerator (GTA), with which we will perform experiments to produce high-brightness particle beams. When fully operational, the GTA will demonstrate several advanced features required for an NPB system that operates in space. NPB technology could also have numerous nonmilitary applications in industry and medicine.

Laser research is not new to Los Alamos. Because of their many potential military and energy applications, we have worked to develop high-power lasers since the late 1970s. In our research programs, we are developing a variety of laser systems that range from free-electron lasers (FELs) for ballistic missile defense to advanced short-wavelength lasers that may be used to produce more miniaturized integrated circuits.

Our FEL program, which plays a major role in the Strategic Defense Initiative, differs from other approaches in that we use an electron-beam accelerator driven by radio-frequency power. This feature has important advantages for transmitting powerful light beams to distant targets.

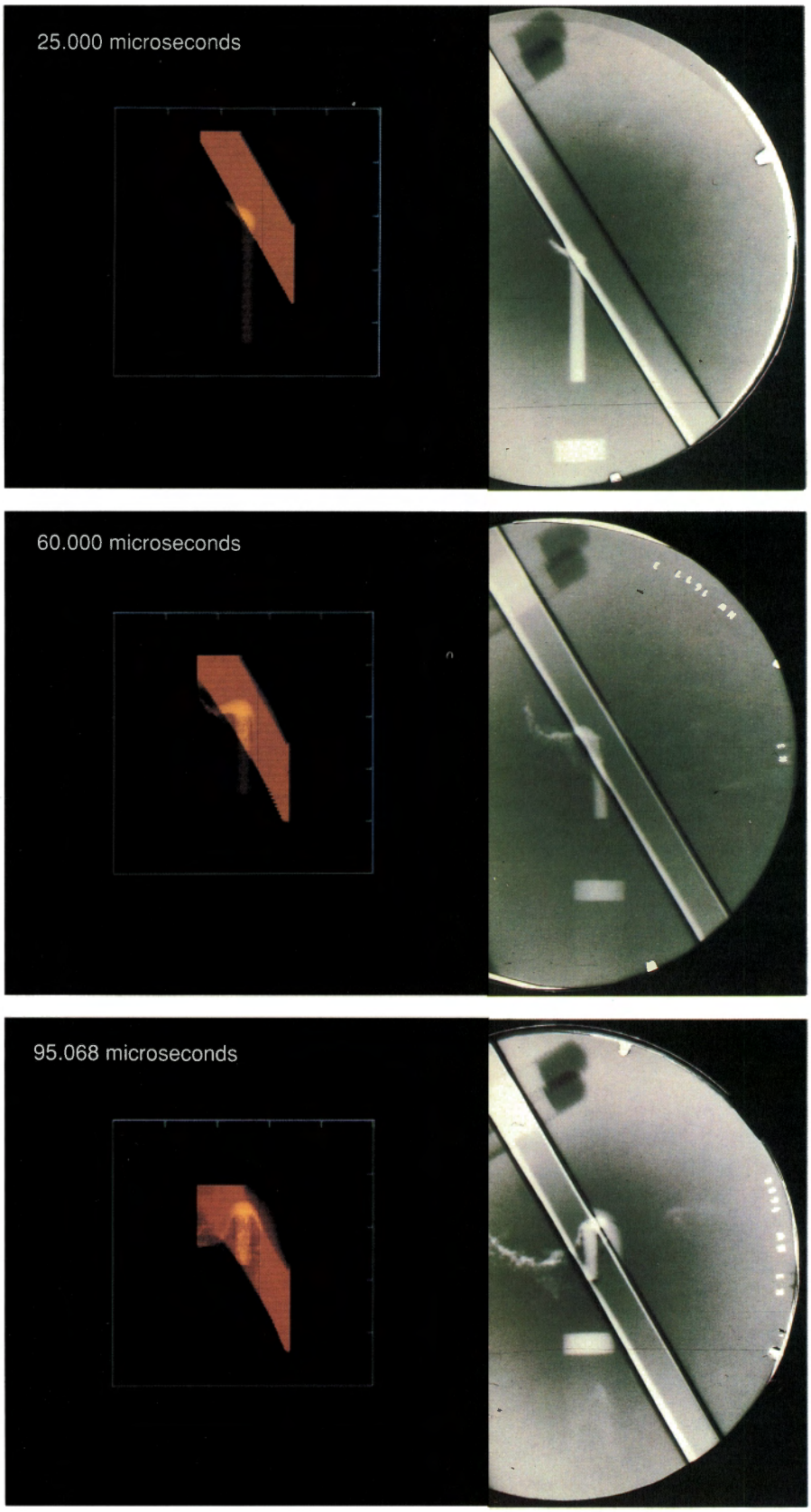
Advances in FEL technology have also enabled us to address the next major step in large-scale production of integrated circuits. By using an FEL to generate ultraviolet light with very short wavelengths and by using highly reflective mirrors, we expect to develop an efficient way to produce semiconductor chips that will be ten to twenty times more effective than current chips.

Los Alamos scientists have developed an optically pulsed, laser-driven injector, called a photoinjector, that improves the performance and reduces the cost of operating the FEL. The photoinjector opens the door to a host of medical and industrial applications: FEL light can be used to coagulate, cut, or remove tissue and to interact selectively with specific cells. It also has possible uses in fields such as welding, communications, and chemical processing.



At the Ground Test Accelerator (GTA), we will convert basic neutral particle beam technology into engineering prototypes and test both individual components and the prototypes as integrated systems. The GTA will demonstrate advanced-technology features required for a neutral particle beam system that must operate in space.

Results from testing in the Los Alamos Armor/Anti-Armor Program, combined with theoretical modeling and computational analysis, allow us to improve conventional weapons technologies.



Computer modeling is fast becoming a major tool for developing protective armor. On the left are computer simulations of a metal rod penetrating a steel plate. Researchers compare these simulations with x-ray photographs of an actual ballistic impact (right). They use the information to better understand the dynamics of projectiles and to improve weapons design.

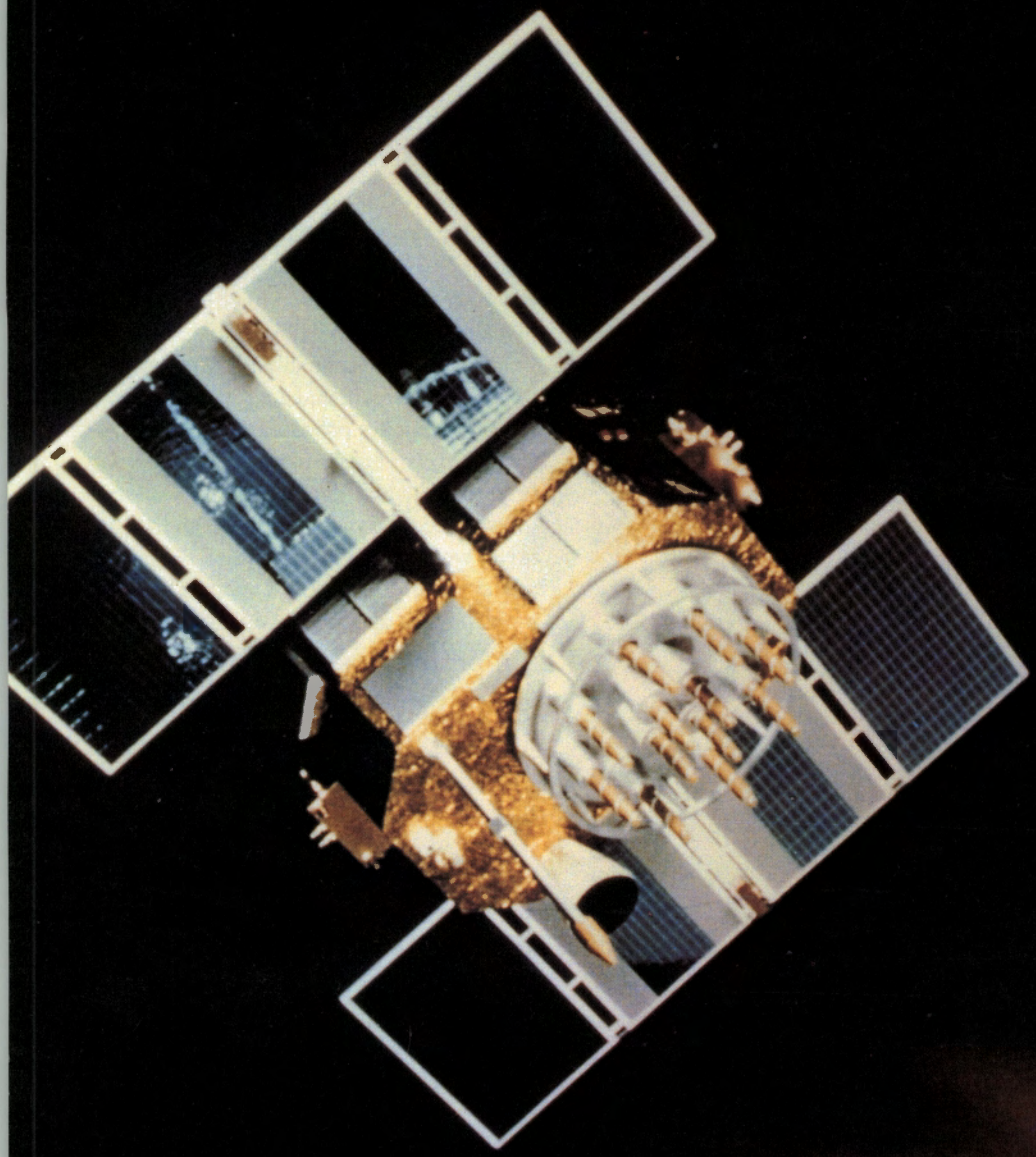
Both the NPB and FEL programs are team efforts with industry that exemplify how a national laboratory and private companies can work together to solve national defense problems. These collaborations with industry will help transfer technology from the laboratory to the private sector.

In advanced conventional munitions, our projects both use and broaden the computational capability and technology base that support the nuclear weapons program. Our experience in high explosives, materials research, and a wide range of multidisciplinary programs contributes to the success of our conventional weapons research. Explorations into the influence of advanced armors, munitions, and novel weapons on future battlefields take advantage of Laboratory expertise in areas such as dynamic testing and theoretical design.

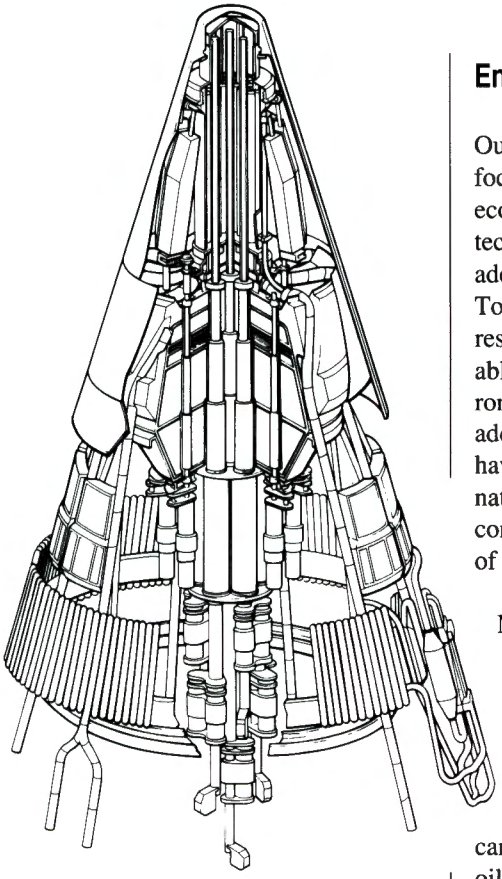
Los Alamos was designated the Advanced Technology Assessment Center (ATAC) to help the army develop both highly protective armor for its own forces and new methods for piercing enemy armors. ATAC will test and assess the effectiveness of a variety of proposed solutions to armor/anti-armor problems. A primary goal of ATAC is to facilitate the flow of resultant technology to private industry.

Many experts believe that over the next decade drug trafficking, terrorism, and low-intensity conflict will pose the most likely threat to national security. With this in mind, we are developing instruments for detecting drugs, explosives, and nerve agents, and we have produced prototype equipment for special military operations.

Ever-changing national security requirements present significant challenges and opportunities for the Laboratory. Using the expertise gained in nuclear weapons research, we can make important contributions to both strategic defense and conventional weapons.



The global positioning system satellite is one of an eventual constellation of twenty-one satellites designed to provide precise navigation signals and to monitor the atmosphere and space for nuclear explosions that might occur in violation of the Limited Test Ban Treaty.

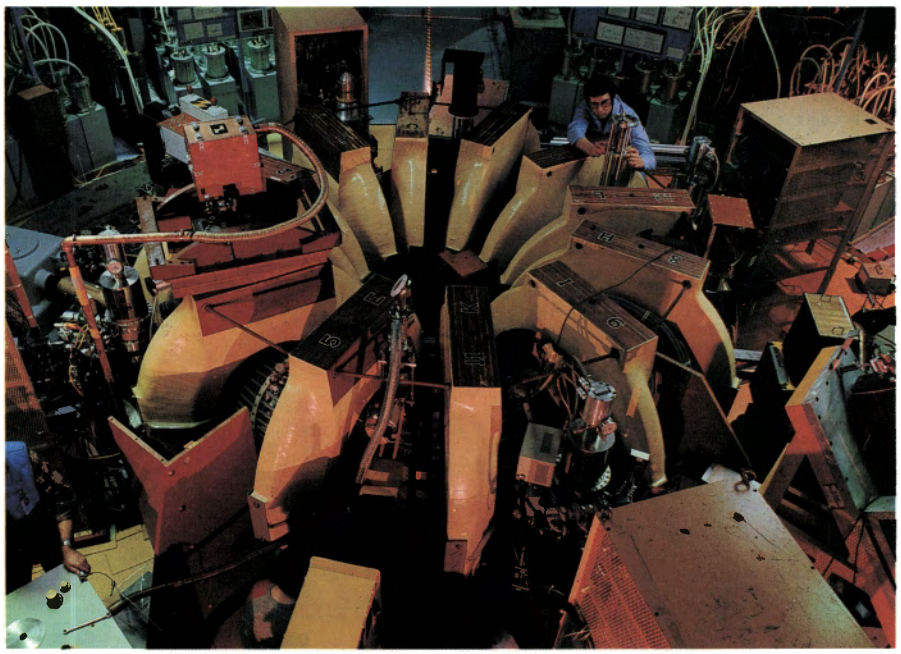


The SP-100 space reactor is designed to serve as a long-lasting source of power for future space missions. Heat generated in the core is transported by one hundred twenty high-temperature heat pipes to thermoelectric converter elements, where part of it is converted into electricity.

Energy and Technology

Our energy and technology programs focus primarily on developing reliable, economic, and environmentally sound technologies that can help ensure an adequate supply of energy for the nation. To meet this need, we are involved in research that ranges from tapping renewable energy sources to studying the environmental effects of energy use. In addition to energy-related research, we have responsibilities that involve the nation's new production reactors, arms control and verification, and the transfer of technologies to the private sector.

National priorities change, and our energy and technology programs must change with them. Laboratory researchers are making a major effort to help solve problems relating to fossil energy. Because conventional oil recovery techniques can extract only 25 to 30 percent of the oil believed to be in domestic reserves, an estimated three hundred billion barrels remain unexploited. New and enhanced oil recovery technologies are needed to allow companies to tap these large, currently unexploited reserves in the United States.



Experiments with the ZT-40M are providing important data on the reversed field pinch approach to magnetic confinement fusion.

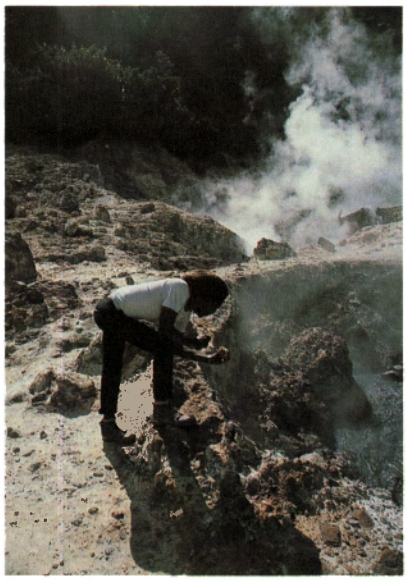
Late in 1988, the Department of Energy initiated the Oil Recovery Technology Partnership to transfer technology from Los Alamos and Sandia National Laboratories to industry. Both laboratories have contributed to developing technologies that are potentially useful to the oil industry.

In addition to our weapons-related inertial confinement fusion work, we are studying ways to harness fusion energy—the process that powers the stars—for generating electrical power. Our approach focuses on systems that use magnetic fields to confine the high-temperature, high-pressure plasma fuel. We are developing dense plasmas as a way to simplify production and potentially lower the cost for magnetic fusion energy.

Laboratory researchers are studying the fusion fuel cycle itself. We must learn to handle, process, and recycle the heavy hydrogen fuels required for controlled fusion reactions. Los Alamos has the free world's only plant for developing and testing a complete and integrated fuel-handling system for fusion reactors, the Tritium Systems Test Assembly. This system can handle the tritium (a heavy isotope of hydrogen) required for a fusion power plant comparable in power output to many commercial coal-fired power plants.

The Laboratory also develops technologies related to nuclear fission reactors. Nuclear fission, pioneered by the Laboratory years ago, now provides 18 percent of the nation's electric power. To help ensure the safety of nuclear power plants, we created computer programs that predict and analyze reactor behavior during simulated accidents. Our goal is to understand what happens during accidents so that we can avoid them or minimize their effects.

At Fenton Hill, New Mexico, about twenty miles west of Los Alamos, we completed the world's first hot dry rock geothermal reservoir.



Through our international technology assistance efforts, we provided data on local geothermal resources to the government of St. Lucia. Here, a native of St. Lucia examines sulfur deposits at a geothermal area.

For more than twenty years, Los Alamos has made important contributions to safeguarding nuclear materials. Our safeguards and security experts work with the International Atomic Energy Agency (IAEA) and key nations to create a credible global safeguards verification system. Los Alamos has developed many tools used by IAEA inspectors for on-site, nondestructive assays of nuclear materials, and all IAEA inspectors receive part of their training at Los Alamos.

Los Alamos recently was named the lead laboratory for providing comprehensive and independent reviews of the preliminary designs for the new production reactors that will replenish the nation's supply of tritium. We are responsible throughout the program for verifying that all performance and production goals are met safely and reliably.

The domestic renewable energy resource is enormous, hundreds of times larger than current domestic energy consumption, and is expected to increase steadily. In the hot dry rock project, scientists study geothermal energy, a seemingly inexhaustible source of energy within the earth's crust. This renewable resource can be found in almost every part of the country and has few effects on the environment. A vigorous alternative-fuel program focuses on fuel cells as a substitute for the internal combustion engine. More efficient and cleaner burning than the internal combustion engine, fuel cells could become a practical power source for the transportation and utility industries.

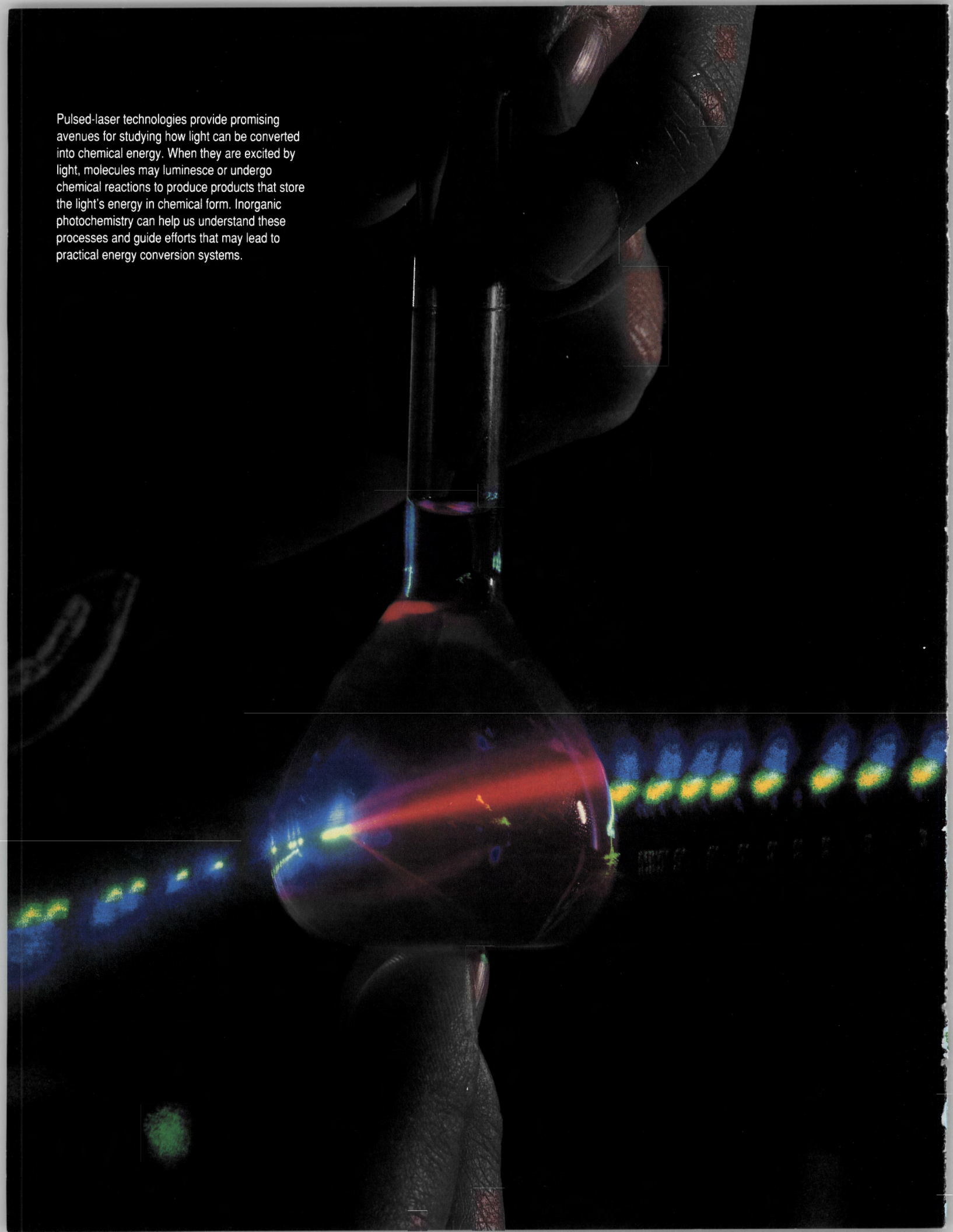
National debate has intensified on the environmental effects of nuclear weapons production, energy use, and global changes—topics that concern both the public and government agencies. For example, the Departments of Defense and Energy closely monitor their facilities to assess environmentally safe operations. We are directing a major effort toward environmental cleanup and civilian and defense waste management problems, most of which are related to hazardous and toxic wastes. Based on our far-reaching experience in managing radioactive wastes, we are well qualified to address these issues.

Los Alamos, Oak Ridge, and Argonne national laboratories were named Superconductivity Pilot Centers by the Department of Energy. Our part of the program focuses on synthesizing new materials to use as superconductors—materials that can transmit electricity with no loss of energy and have possible applications in energy conservation.

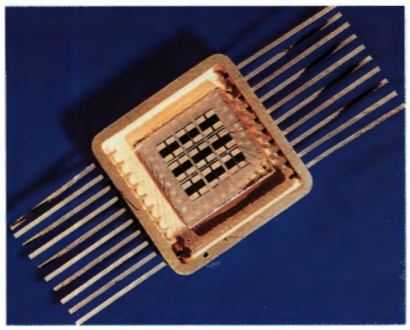
Arms control and verification have been important Laboratory activities since 1963, when the Limited Test Ban Treaty was ratified. The treaty requires monitoring any nuclear tests in the atmosphere, ocean, or outer space. Los Alamos continues to have the principal monitoring responsibility for outer space.

Today we see the need for verification technology in many areas besides nuclear test monitoring. Controlling weapons in space presents technical challenges, as do the very difficult problems of verifying chemical and biological warfare treaties. We are trying to ensure that our technical capabilities address verification problems of the coming decades.

Through the International Technical Assistance Program, we share our scientific capabilities with other nations. Our goal is to strengthen the technical bases of participating countries by developing their natural resources and enhancing their energy planning capabilities. For example, the Central American Energy Resources Project assists developing nations in tapping indigenous energy sources to replace costly energy imports. Participating in this project are Guatemala, El Salvador, Honduras, Costa Rica, and Panama.



Pulsed-laser technologies provide promising avenues for studying how light can be converted into chemical energy. When they are excited by light, molecules may luminesce or undergo chemical reactions to produce products that store the light's energy in chemical form. Inorganic photochemistry can help us understand these processes and guide efforts that may lead to practical energy conversion systems.



We are developing high-temperature superconducting infrared detectors that can "see" cold objects, such as tanks at rest or satellites in outer space, in spite of darkness or weather conditions. Current detectors sense only hot objects. The ability to detect cold objects is important to U.S. defense and to verification of arms control treaties.

Chemistry and Materials Research

Since its beginnings, Los Alamos has emphasized excellence in chemistry and materials science. Work in these areas is central to our multidisciplinary approach to research—and essential to our mission of national security.

In a far-reaching materials science and technology program, the Laboratory conducts research in metallurgy and ceramics, high-temperature superconductivity, materials chemistry, and condensed-matter physics. We study the properties of materials under extreme conditions such as high pressure, high electric or magnetic fields, and high irradiation to predict failure limits and also to develop materials that better withstand these extreme conditions.

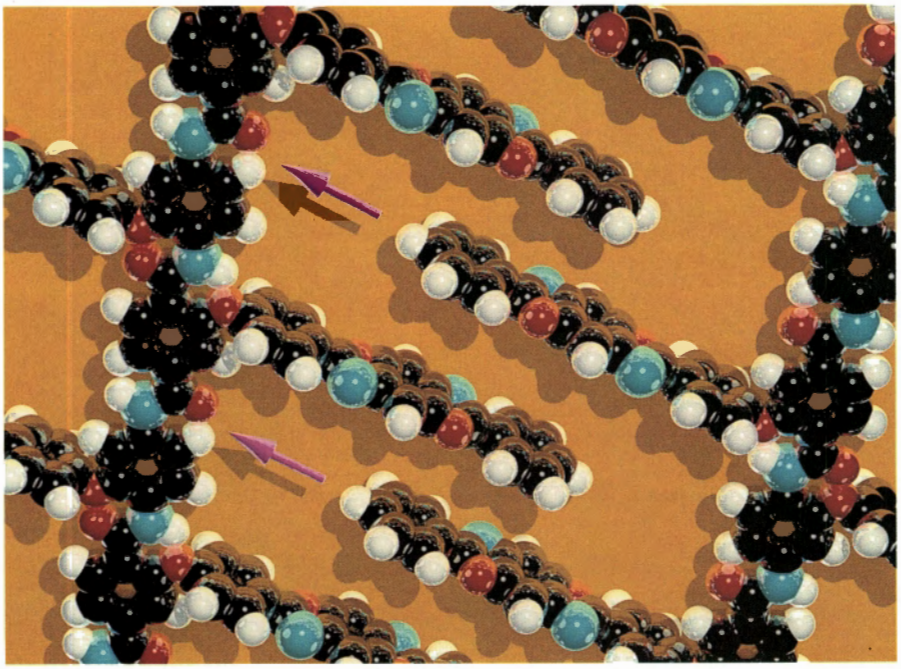
New technologies often are limited by available materials to do the job. Developing and fabricating new substances tailored for particular applications are increasingly important to defense, energy, communications, and environmental control. Los Alamos recently designed a new class of superstrong polymers, with applications in both defense and industry, that have strength in three dimensions, rather than only one, and could be used in highly stressed components of airplanes, automobiles, and machines.

Stringent requirements for special materials needed in nuclear weapons also lead to new techniques for developing and fabricating strategic materials—techniques that often have commercial applications. New materials have been developed as well, such as inexpensive, lightweight but tough ceramics for armor and high-temperature applications.

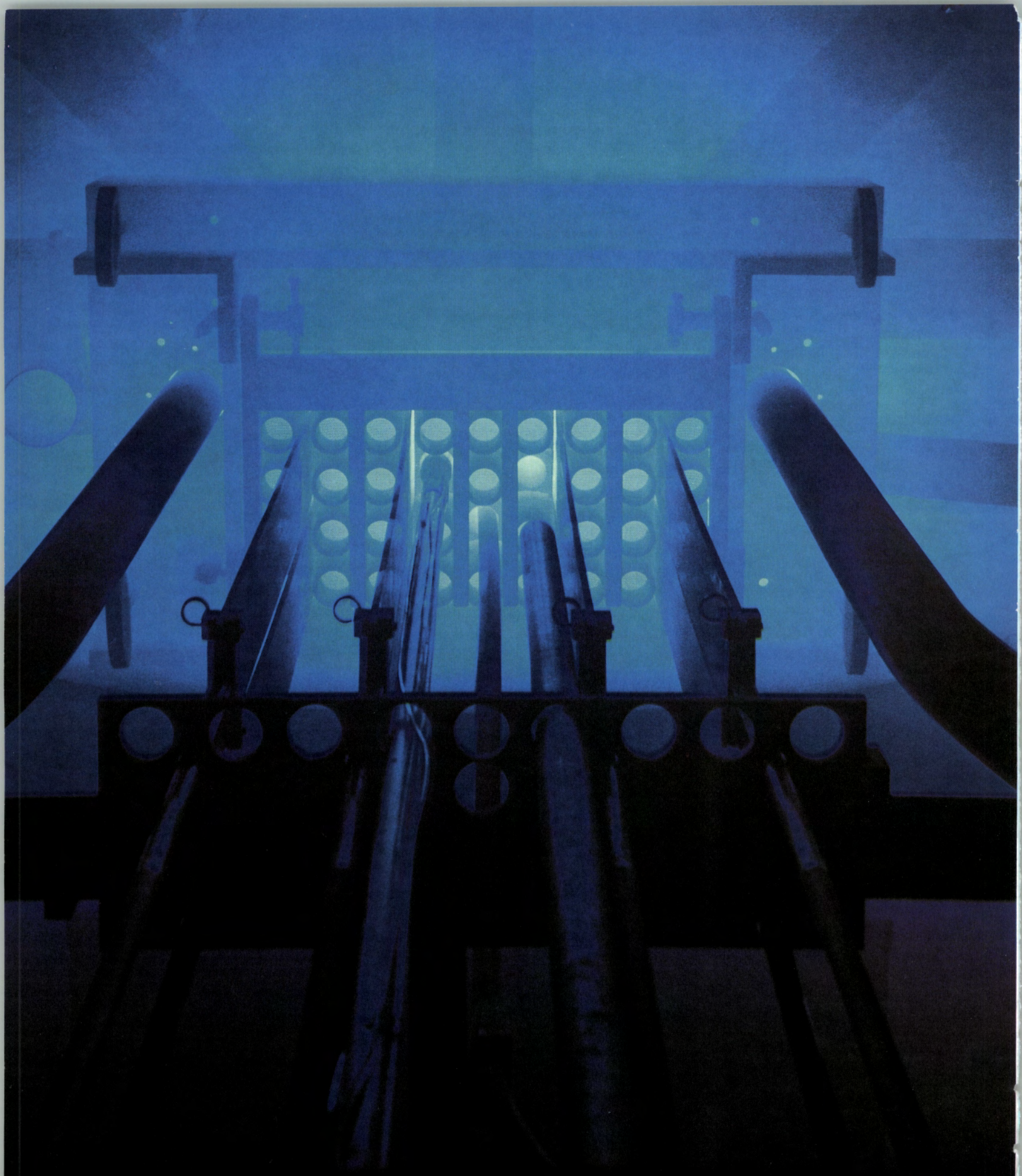
Many existing applications of specialty materials can benefit from novel processing ideas, such as developing plasma-spray methods for manufacturing layered composites for high-strength applications. Because beryllium has an attractive combination of high strength and low density, we are trying to develop novel beryllium alloys that will retain strength and toughness at high temperatures for aerospace use.

Our chemistry expertise—including radiochemical, actinide (subset of radioactive elements), analytical, physical, nuclear, and environmental, to name a few important areas—is a significant part of most Laboratory programs. Radiochemical diagnostics of weapons tests plays a major role in maintaining a strong national defense. Our expertise—matched nowhere else in the world—results from our pioneering work in developing radiochemistry as an essential tool for nuclear weapons test diagnostics. Work to determine the energy release of all Los Alamos nuclear tests at the Nevada Test Site provides many details of the physics and chemistry of nuclear explosions.

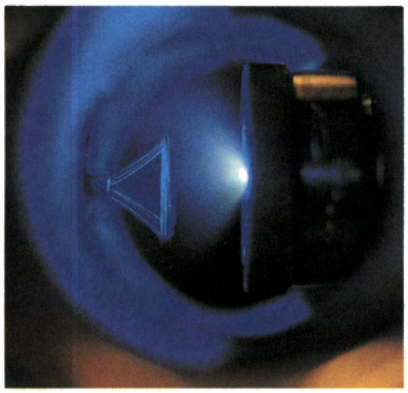
In actinide research, we are developing a highly efficient method for using powerful oxidative fluorinating agents to recover and purify plutonium. In another effort, we discovered that extremely strong acids attack highly resistant materials containing actinides. This ability is unmatched by any other known class of compounds and should prove useful in plutonium reprocessing operations.



This computer-generated drawing shows the alignment of superstrong polymer molecules—an entirely new class of polymers. Superstrong polymers may become stronger, lighter-weight replacements for metals, ceramics, and other materials in various structural applications, such as automobile and airplane parts, armor, protective clothing, and building materials.



A blue glow from Cerenkov radiation is emitted by the core of the Laboratory's Omega West research reactor.



This plume was generated during the preparation of high-temperature superconducting thin films. The blue light is scattered laser radiation, and the white plume is due to emission from the laser-generated plasma.

Analytical chemists perform tens of thousands of analyses annually on thousands of samples. We analyze for any element in the periodic table, many of which are associated with production and research activities at the Laboratory's plutonium facility.

Our expertise and capabilities in physical chemistry provide essential support to numerous programs. Efforts are under way to more fully understand energetic materials and to enhance the effectiveness of explosives. We are also studying the unique supersonic combustion requirements of the National Aerospace Plane propulsion system. In a laboratory that simulates the environment of low-earth orbit, we test how materials survive in space. Another major project involves understanding the fundamental chemistry necessary to convert the vast resources of natural gas (methane) into easily transportable natural fuel (methanol).

Laser systems developed at Los Alamos are important to national efforts such as inertial confinement fusion and strategic and tactical defense. For the inertial confinement fusion program, we are evaluating the krypton fluoride laser developed at Los Alamos as a possible spark plug for the fusion reaction.

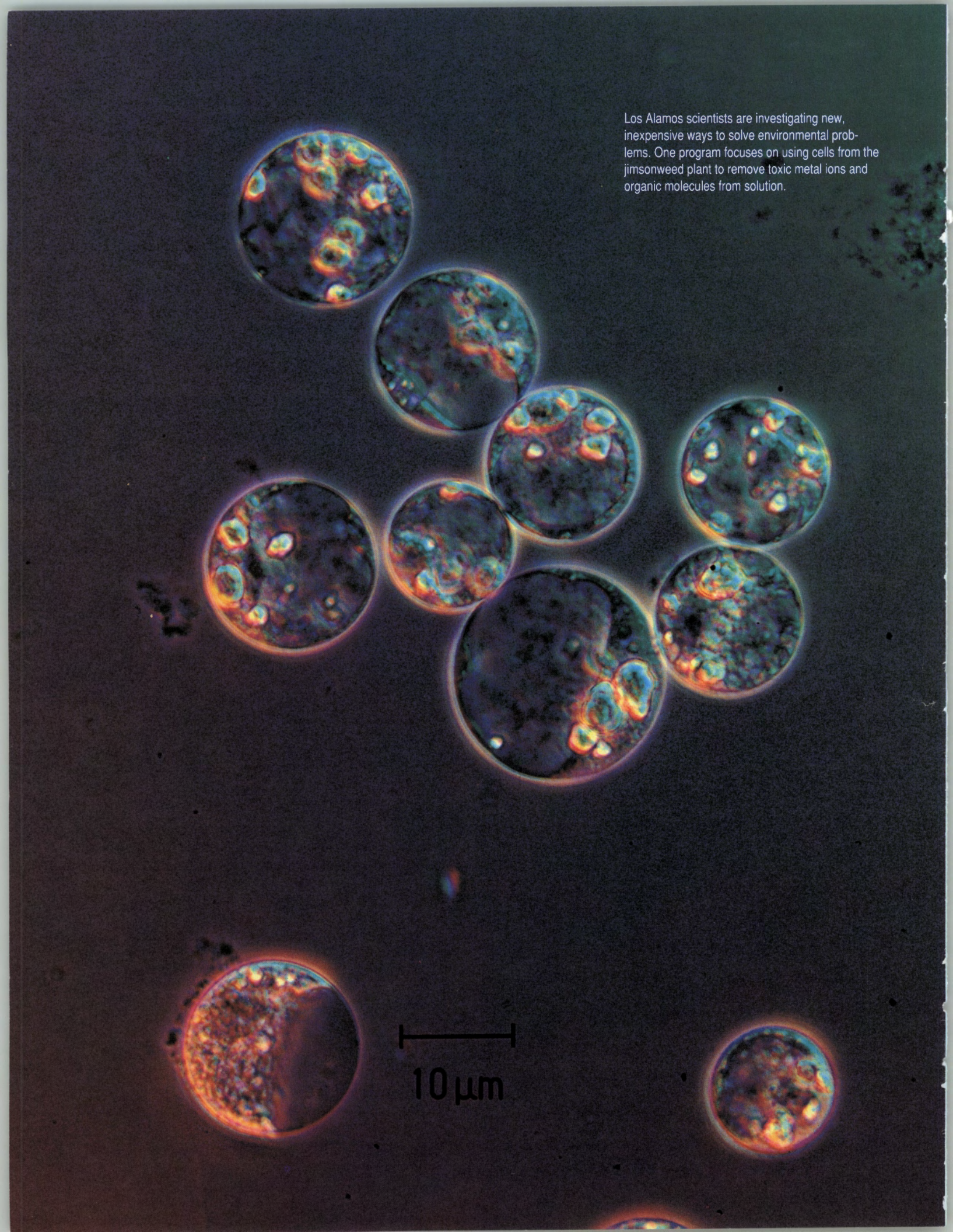
At Yucca Mountain, located adjacent to the Nevada Test Site, we evaluate geologic formations in an area that is a possible repository for high-level nuclear waste. Characterizing Yucca Mountain is one of our largest nuclear waste research efforts.

The first-generation krypton fluoride laser—Aurora—recently achieved an important milestone by producing powers of 100 trillion watts per square centimeter. We are designing an extreme ultraviolet free-electron laser that would be tunable and brighter than any available in this spectral range and would have broad applications in chemical, materials, and biological sciences.

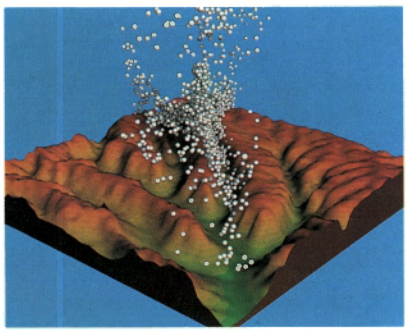
Los Alamos is a national resource for radioactive isotopes. These tracers, which we ship all over the world, are valuable tools in physics, chemistry, and biology, and we use them in our own nuclear medicine effort, especially for earlier detection and treatment of disease. The National Institutes of Health's National Stable Isotope Resource at Los Alamos produces specific isotopic compounds that are the necessary starting point for many health-related investigations and environmental problem solving.

To help solve environmental problems such as acid rain, ozone depletion, and hazardous waste, we study the interactions of raw materials and processes that generate possibly harmful wastes, and we design and implement environmental control strategies. Our ultrasensitive mass spectrometer laboratory, the Advanced Radiochemical Weapons Diagnostics Facility, is one of the world's best for measuring hazardous material in the environment.

One of our largest nuclear waste research efforts—characterizing Yucca Mountain, Nevada, as a possible repository for high-level nuclear waste—depends on multidisciplinary capabilities and unique analytical expertise to understand the extremely complicated environment of the potential waste repository. A crucial part of our work is evaluating the likelihood that radioactive materials will migrate from the repository into local groundwater.



Los Alamos scientists are investigating new, inexpensive ways to solve environmental problems. One program focuses on using cells from the jimsonweed plant to remove toxic metal ions and organic molecules from solution.



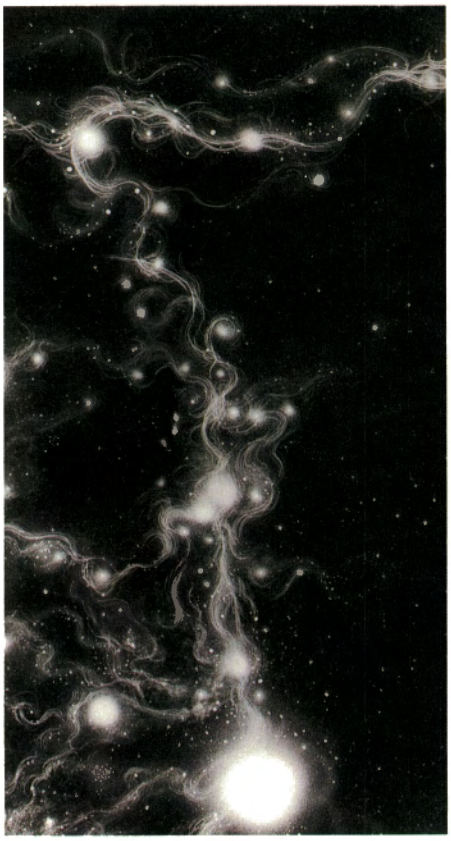
A three-dimensional computer model was used to simulate the dispersion of pollutants in a mountainous area north of Grand Junction, Colorado. This model is useful for weather forecasting and air quality predictions. Adapted for use on microcomputers, it represents a cost-effective tool for conducting atmospheric research.

Basic Research

$$\frac{\partial}{\partial t}\int^{B} u\,dx$$

The search for new knowledge —basic research—is a never-ending quest to understand the universe and to improve the quality of life. Challenges and discoveries in basic research often lead to new ideas or applications, the practical but unpredictable consequences of scientific inquiry.

As a multidisciplinary scientific institution, Los Alamos carries out basic research of the highest quality in an extensive range of scientific fields, from nuclear and particle physics to the biosciences. This research is helping us understand issues as varied as environmental contamination, energy, waste disposal, susceptibility to diseases, and physical processes that govern wind and turbulence.

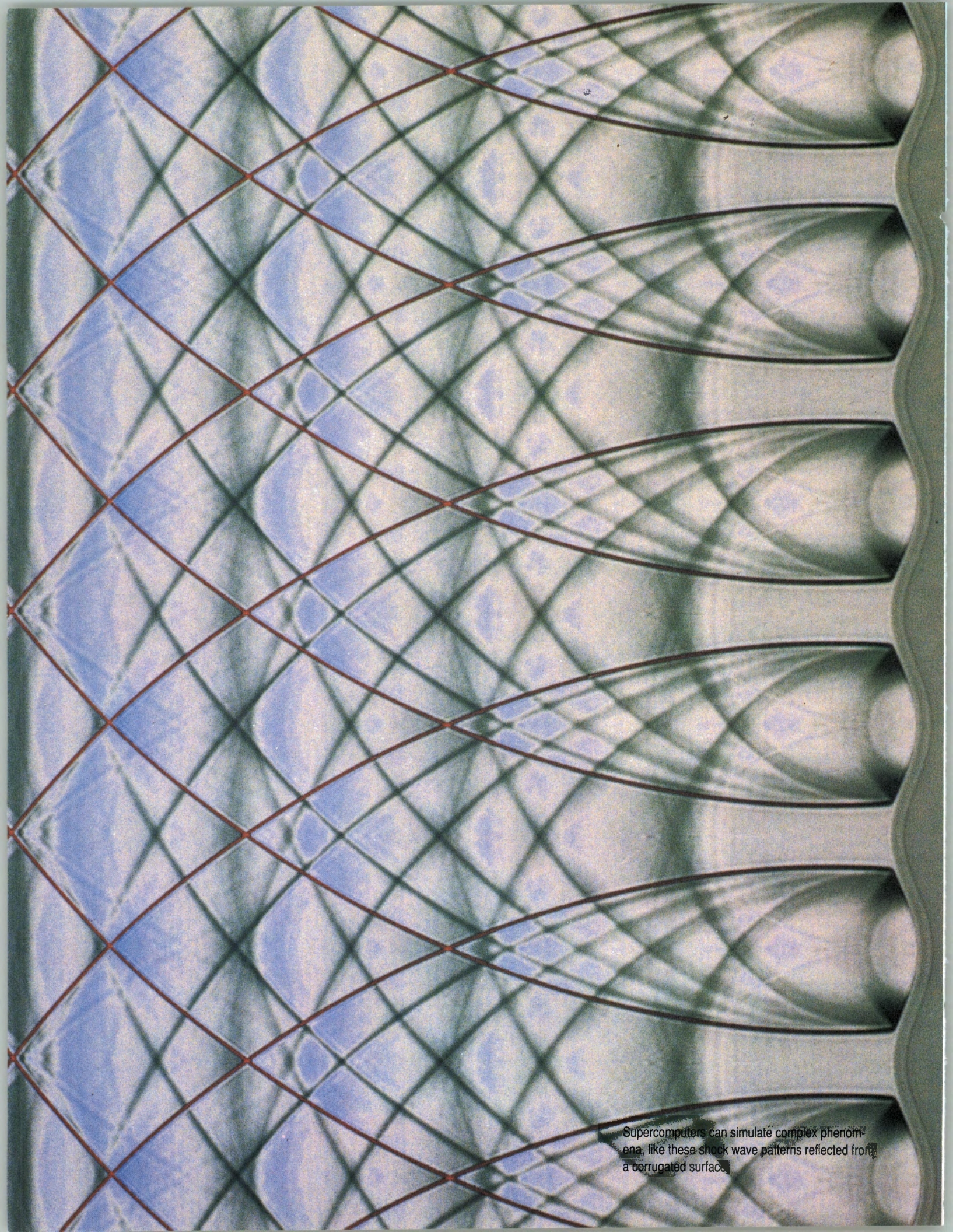


Long strands and loops of cosmic string, an extremely heavy and extremely thin form of matter, may account for the patterns of stars and galaxies we observe.

Much basic research at Los Alamos since the 1940s has been in physics. Supporting this research is the Clinton P. Anderson Meson Physics Facility, which houses the world's most powerful and sophisticated medium-energy proton accelerator. With its unique accelerator-generated beams of subnuclear particles, scientists study fundamental laws and interactions of particles, condensed-matter and atomic physics, and nuclear structure and chemistry.

A new direction in physics research is our "bright source" experimental program. Scientists are analyzing the interaction of matter by using very intense laser beams under conditions that cannot be studied with conventional methods. Using our Bright Source II laser, we examine atomic states and processes in a precise way that no other method has rivaled.

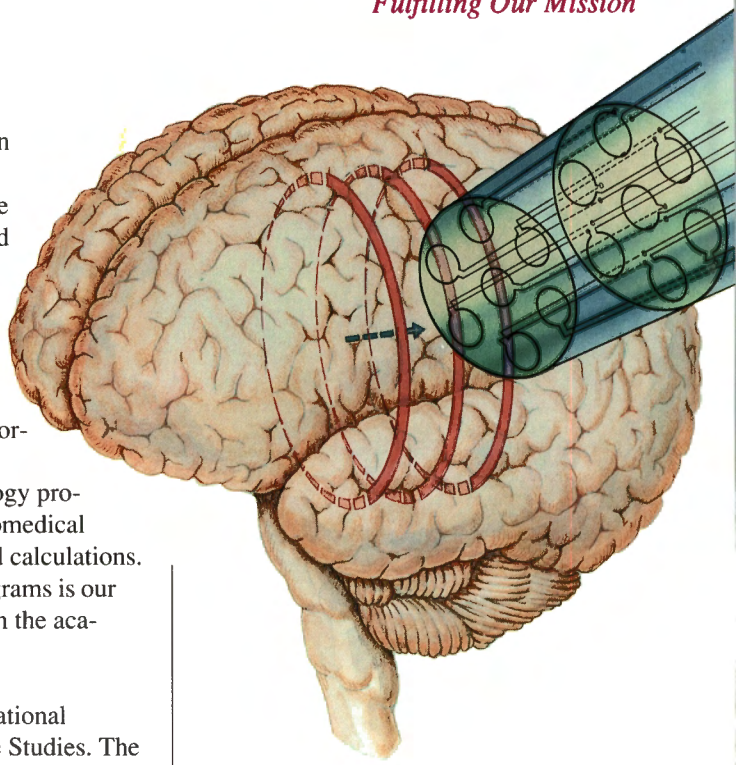
Supporting all our research at Los Alamos is our strong capability in computational science, especially advanced computational modeling and parallel processing. Because of this capability, the Laboratory was chosen by the National Science Foundation to become part of a consortium (with Rice University, the California Institute of Technology, and Argonne National Laboratory) to establish a Science and Technology Center for Research in Parallel Computing. The Laboratory's combination of technological skills and resources in computational science and the biosciences has made it the home of many national resources and special capabilities.



Supercomputers can simulate complex phenomena, like these shock wave patterns reflected from a corrugated surface.

Scientists at Los Alamos have identified the coded DNA component, called the telomere, found at the end of the chromosome. The lightest spots indicate hybridization—a process in which a repetitive DNA probe has bound to chromosomal DNA—at the telomere. The large object in the top section of the photograph is a cell nucleus. Understanding DNA sequences is important for mapping human chromosomes and for studying the functions of repetitive DNA.

Los Alamos has pioneered in applying several unique resources to the study of life sciences that were developed in our physics program. Magnetoencephalography is a new concept based on the ability to sense very weak magnetic fields, thus allowing noninvasive monitoring of human brain activity. Accelerator-related technology provides tools for improved biomedical techniques, instruments, and calculations. A key element of these programs is our successful collaboration with the academic and private sectors.



Los Alamos is one of two national Centers for Human Genome Studies. The goal is to map and sequence the human genome, that is, the full set of instructions for a human being. This research is crucial to determining the genetic basis of many human diseases; so far, more than four thousand genetic diseases have been identified.

Techniques developed for studying gene structure are also useful in studying DNA damage and repair. In response to worldwide requests for DNA from specific human chromosomes for research, Los Alamos and Lawrence Livermore National Laboratory collaborated to construct recombinant DNA libraries. The gene library project, together with GenBank, the national computer library for storing and studying nucleic acid sequences, provides a sound basis for associated work by the Center for Human Genome Studies.

In addition to genetic issues, we are investigating the health risks associated with exposure to radiation and other occupational hazards. In epidemiological studies, we examine mortality rates, disease incidence, and causes of death in plutonium-exposed workers and unexposed workers in six major Department of Energy installations. With information from these studies, we can validate and improve computer models and evaluate the effects of plutonium in the environment on the general population.

One issue of special concern to the nation is the protection and cleanup of the environment. Los Alamos bioscientists are studying several ways to mitigate environmental problems caused by nuclear and chemical waste. In related studies, we have shown that jimsonweed and cells derived from this plant can absorb metallic ions from solution. We are characterizing the metal-absorbing components of the plant cells so we can produce this material for particular applications, such as removing metals from industrial waste before it is discharged into the environment.

In our atmospheric sciences program, we are investigating—both experimentally and theoretically—the influence of terrain on the transport and diffusion of gases. Applying principles and models developed from a combination of unique disciplinary skills will make our regional environmental assessments more reliable.

Our broad range of basic research keeps us at the forefront of new scientific and technical knowledge. Excellence in basic research enables us to perform our primary mission while providing important general benefits to society.

The red spot on Jupiter is a striking example of natural structures that originate from nonlinear fluid dynamics, a subject actively studied at Los Alamos.

INTERDISCIPLINARY RESEARCH CENTERS AND RESOURCES FOR CREATIVE THINKING

Computation has now joined theory and experiment as an investigative tool. Scientists who once were limited to their laboratories can, with the help of computers, soar to the far reaches of the galaxy or move forward and backward in time.

Central Computing Facility

Los Alamos has been in the forefront of scientific computing since the 1940s. Today our computing capabilities equal or exceed those of any other scientific computing center in the world. The Integrated Computer Network (ICN) consists of computing power equivalent to about sixty-five CRAY-1 computers. We can store more than eleven trillion bytes of data in about four million files; 95 percent of that information can be retrieved in less than six seconds by a system that was developed here and is being duplicated elsewhere. Our powerful computing capabilities are involved in every major program in the Laboratory. They play a significant role in understanding such diverse research as human genetic structure, safe nuclear reactor designs, and heat transfer in the earth's mantle.

Advanced Computing Laboratory

In 1988, we established an Advanced Computing Laboratory that will serve as a gateway for interactions with universities, industry, and government. This laboratory will provide an innovative environment and experimental computing hardware to study computer applications and problems of the future. Its approach is to team computer scientists and applied mathematicians with physicists, chemists, biologists, and other scientists. These teams will have access to the most up-to-date computing equipment and will help drive the development of leading-edge computing technology.

Institute of Geophysics and Planetary Physics (IGPP)

In 1946, the University of California formed the IGPP at its Los Angeles campus to serve as a center for scientists working in the many specialties relevant to the Earth and other planets. In 1980, a branch was established at Los Alamos, bringing to five the number of IGPP branches. A special purpose of the Los Alamos branch is to develop stronger ties between researchers at the Laboratory and those on the University campuses. The branch supports broadly based research in geology, geochemistry, geophysics, atmospheric sciences, space sciences, and astrophysics.

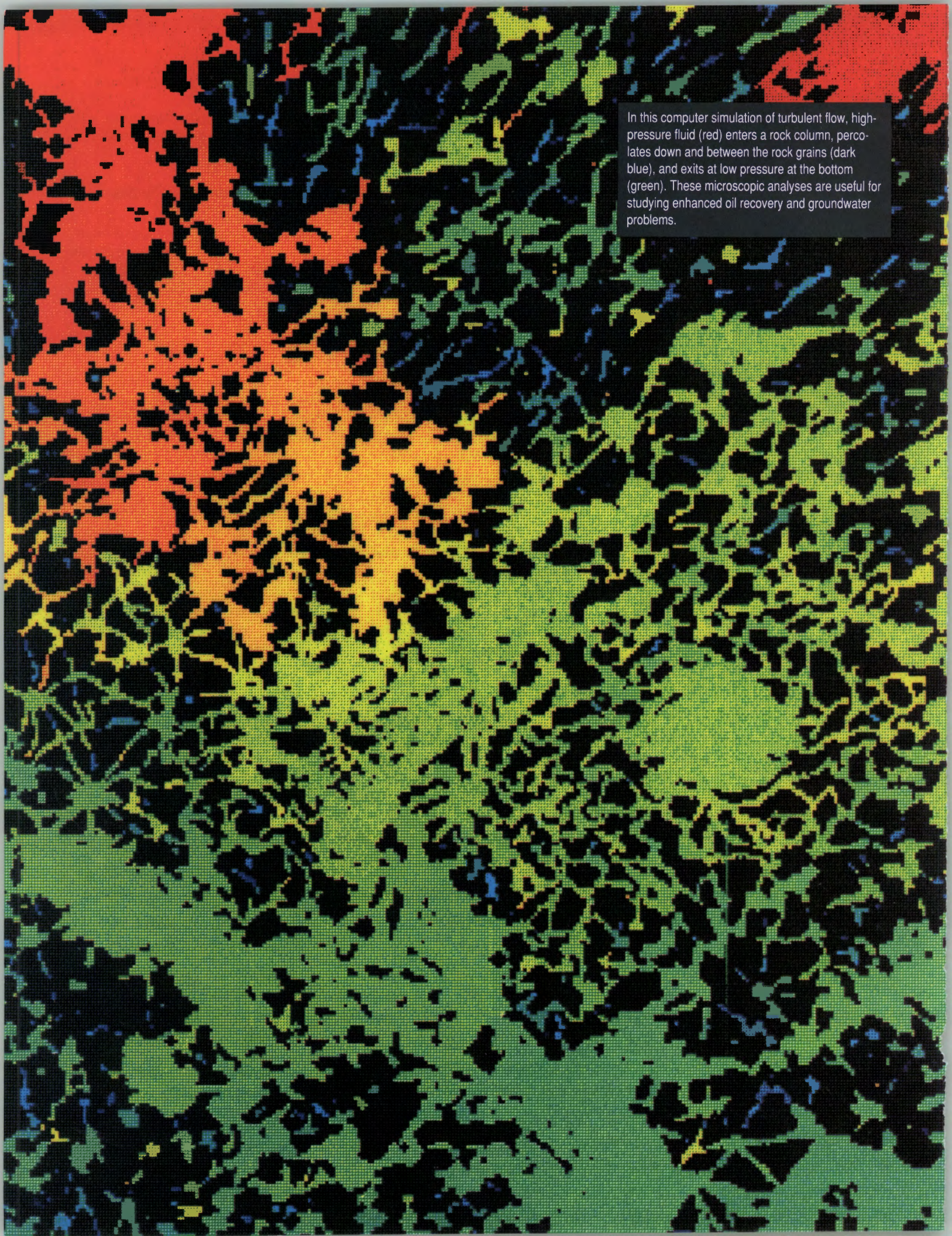
Center for Nonlinear Studies

The center conducts scientific research on nonlinear problems, encourages interdisciplinary research, and encourages interactions between Laboratory and university mathematicians and scientists. Nonlinear processes are characterized by chaotic features or by the abrupt appearance of integrated structures (such as vortices, tornadoes, and hurricanes) or by both. Because many of the Laboratory's energy and defense programs involve complex nonlinear phenomena, developing analytical methods for nonlinear systems has broad applications.

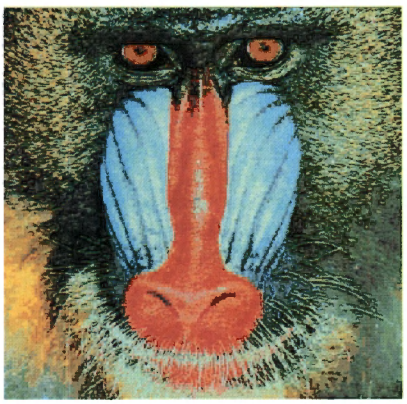
Center for Materials Science

The center was founded in 1981 to focus materials research and development activities within the Laboratory and strengthen interactions with the national materials science community. The center supports workshops, visitors, and collaborations with university researchers. Virtually every experiment or design that we undertake is limited by the understanding or availability of materials to do the job.

Los Alamos scientists are using a magnetic field to produce highly anisotropic conducting polymers whose electrical conductivities are comparable to those of metals such as copper. These polymers are flexible, lightweight, and easy to produce, with possible applications in microelectronics and the aerospace industry.



In this computer simulation of turbulent flow, high-pressure fluid (red) enters a rock column, percolates down and between the rock grains (dark blue), and exits at low pressure at the bottom (green). These microscopic analyses are useful for studying enhanced oil recovery and groundwater problems.



Data compression dramatically reduces the file size of a digitized image while retaining the quality of the original file. Top. This frame shows the original digitized image of a mandrill. Bottom. The amount of data required to display this image was reduced to 1/32 of the original amount—yet the quality of the two images appears equal.

Center for National Security Studies

The center is a studies and analysis organization whose research focuses on the interaction between technology and policy. It promotes and conducts long-term research in defense policy and arms control. The center helps Laboratory management and technical staff address national defense needs by providing insight into national security policy, strategy, and technology issues and by assisting in long-range planning. The staff is an interdisciplinary one, and there is an active visitor and consultant program.

Center for Human Genome Studies

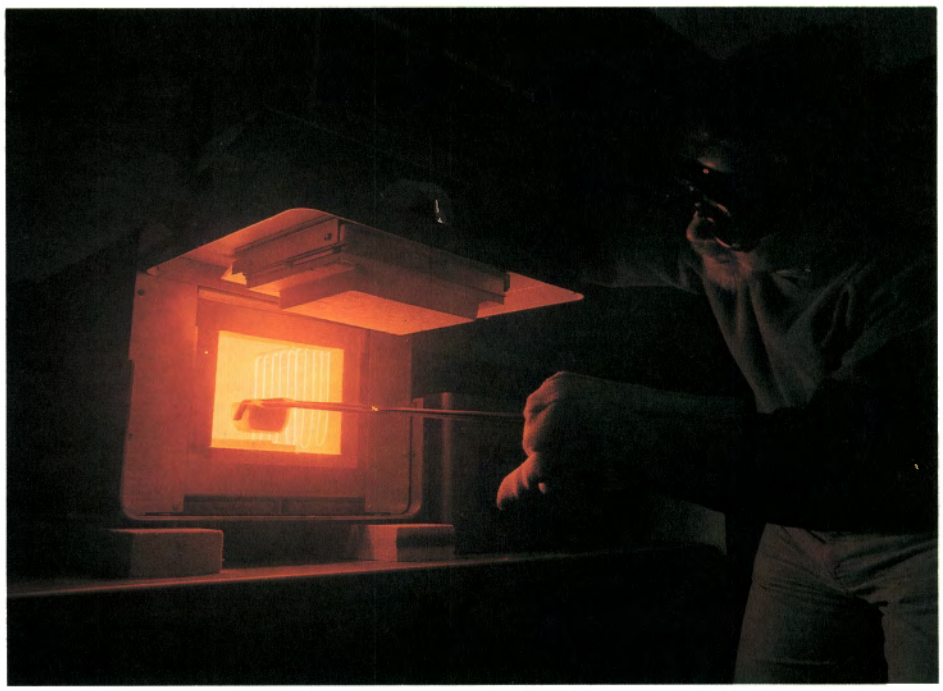
The center was established in 1988 to locate and then decipher the chemical structure of the estimated one hundred thousand genes in the human body. In carrying out the work of the center, Los Alamos will build on its extensive experience with flow cytometry, the GenBank, and its Human Genome Project. New biotechnology will be available for commercial development as it is implemented. Studies of the human genome promise to open a new era in medicine.

Exploratory Research and Development Center (ERDC)

The ERDC program emphasizes basic research, exploratory research and development, and applications development. In 1988, the Department of Energy designated Los Alamos one of three national pilot centers for high-temperature superconductivity. The Pilot Center, which is part of the ERDC, will help meet industry's need to move quickly from research to the marketplace. Close collaboration with industry strengthens both the scientific base and the applications orientation of this research.

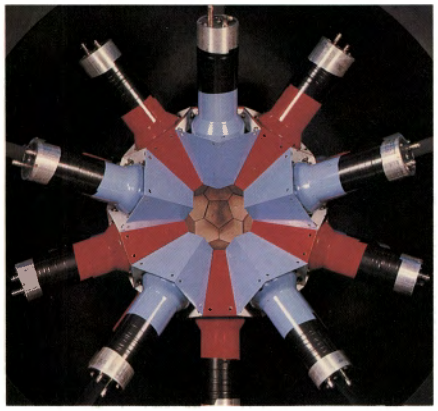
Industrial Applications Office

Recently we have focused on a significant and growing role for the Laboratory—support of national technological competitiveness. Goals of the Industrial Applications Office are to establish new collaborations with U.S. industry and help transfer appropriate technologies to the private sector. In addition, we are working to include the nation's universities in cooperative ventures with the national laboratories and industry.

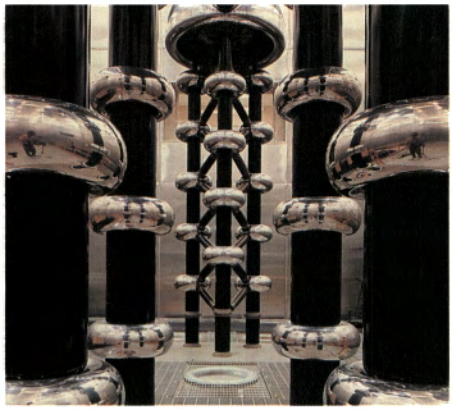


Developing high-temperature superconductors—materials that conduct electricity with minimum resistance—is a major effort at Los Alamos. To increase strength, these materials often are annealed at temperatures as high as 950°Celsius.

In the drift-tube section of the LAMPF accelerator, particles are accelerated to an energy of 100 million electron volts. LAMPF provides unique accelerator-generated beams of protons, pions, muons, neutrons, and neutrinos for scientists and students from more than twenty-five countries.



The BGO Ball is a new particle detector at LAMPF. Its name comes from the use of bismuth germanate (BGO) as the principal scintillating material.



This Cockcroft-Walton generator, one of three at LAMPF, provides the first stage of acceleration for the particles in their half-mile-long journey through the accelerator.

The J. Robert Oppenheimer Study Center houses the Laboratory's extensive technical library and provides space for meetings and conferences.

Clinton P. Anderson Meson Physics Facility (LAMPF)

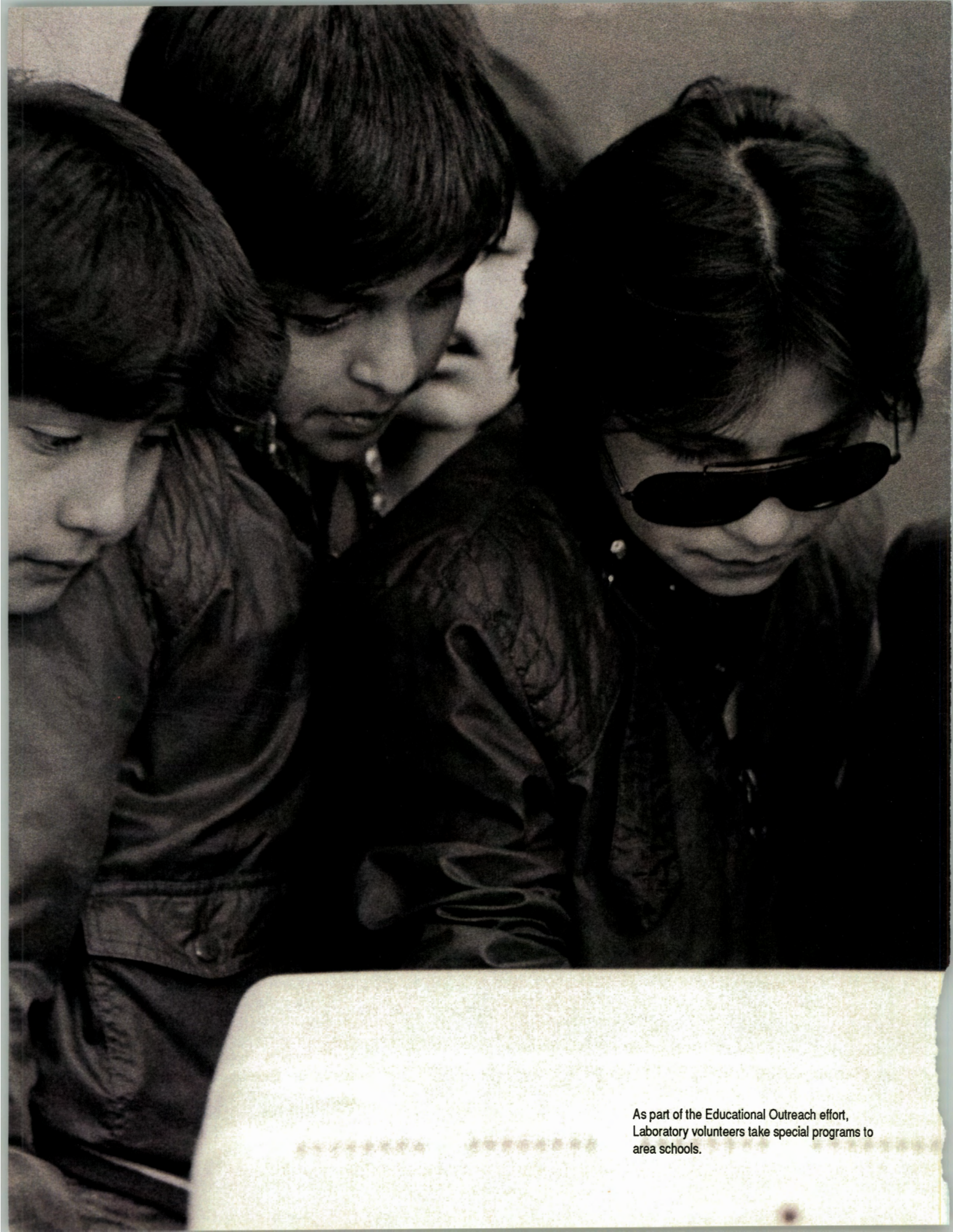
The Meson Physics Facility is the world's largest and most sophisticated medium-energy proton accelerator, which we operate for the physics research community worldwide. The present LAMPF user group consists of approximately eight hundred scientists from the United States and abroad. LAMPF is used to study nuclear and elementary particle physics, atomic physics, nuclear chemistry, radiobiology, and condensed-matter physics. Research results have been applied to medicine, isotope production, defense science, and materials structure.

Manuel Lujan Jr. Neutron Scattering Center (LANSCE)

LANSCE provides a state-of-the-art, pulsed-neutron-scattering capability for research in atomic and magnetic structure, condensed-matter structure and dynamics, and structural biology. This center, like LAMPF, serves the worldwide research community through a formal user's group. LANSCE, which uses proton pulses from LAMPF to produce intense bursts of neutrons, provides unique opportunities to conduct vital applied research as well as world-class basic research.

J. Robert Oppenheimer Study Center

The Study Center houses an extensive technical library, including over three hundred thousand bound volumes, one million classified and unclassified reports, and current subscriptions to two thousand journals. Foreign publications make up a significant part of the total collection. The Study Center offers a place where employees can meet with colleagues from industry, government, universities, and other laboratories. The building lends itself easily to the needs of different visitors—from symposia to technical workshops to international groups requiring simultaneous translation capabilities. Laboratory press conferences and briefings are held here, as well as special functions for visiting dignitaries.



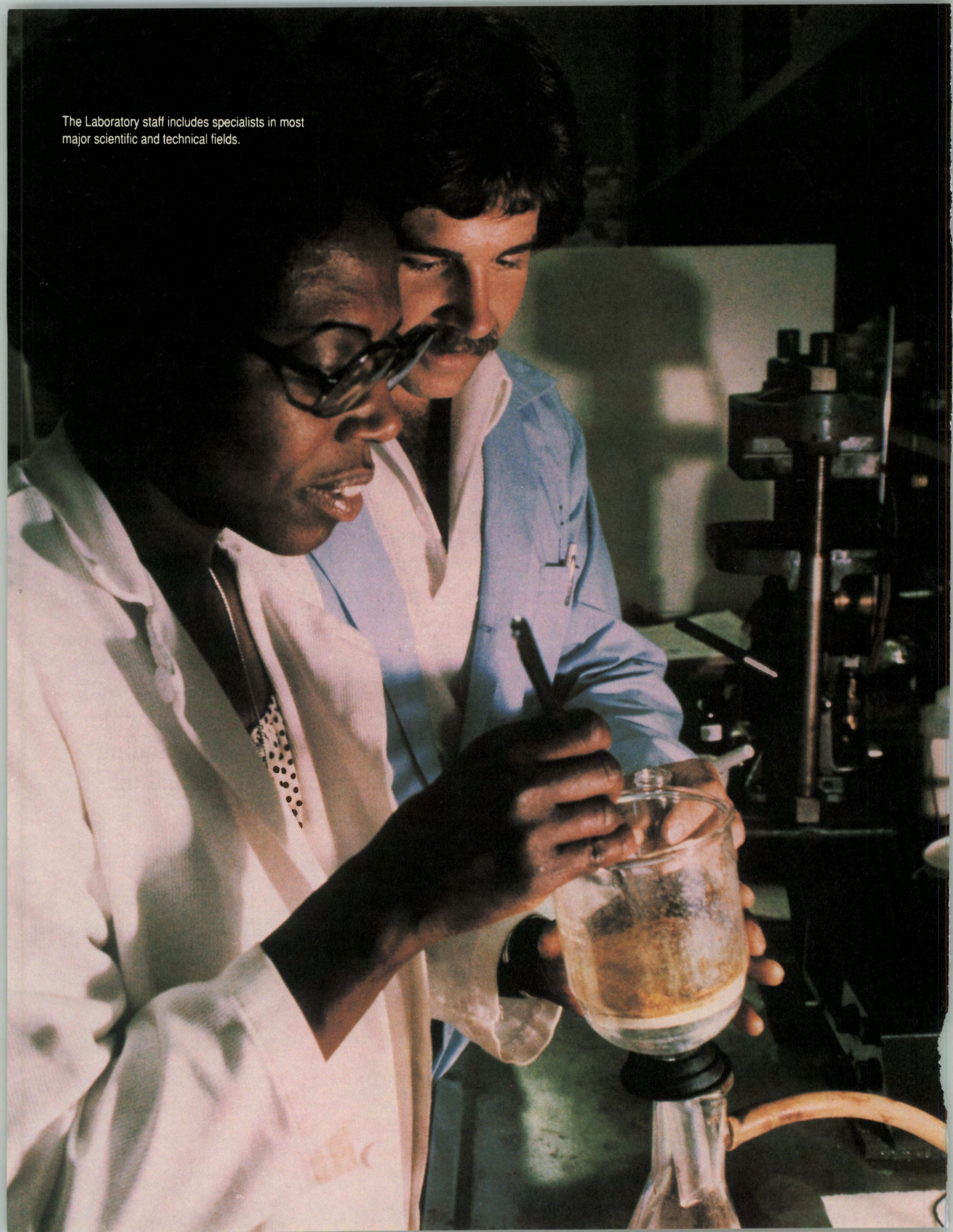
As part of the Educational Outreach effort, Laboratory volunteers take special programs to area schools.

EDUCATIONAL AND EMPLOYMENT OPPORTUNITIES

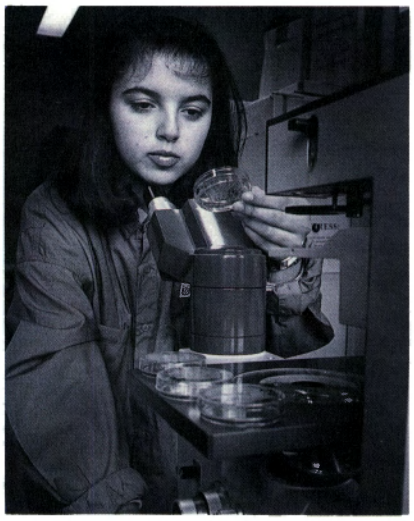
Because Los Alamos is a large, multi-disciplinary laboratory, we need a diverse work force—from physicists and engineers to statisticians and environmental scientists.

The Laboratory employs more than nine thousand people, including about seventy-six hundred regular full-time employees. Of these, more than three thousand are technical staff members, over two thousand are technicians, and the remainder are administrative and general support personnel.

About 50 percent of the technical staff members hold doctors' degrees, 26 percent have masters' degrees, and 23 percent have bachelors' degrees. Almost 34 percent of the technical staff have degrees in engineering, 28 percent have degrees in physics, 12 percent have degrees in chemistry, and the remaining 25 percent represent a wide range of other technical disciplines, including mathematics, computational science, and the geosciences and biosciences.



The Laboratory staff includes specialists in most major scientific and technical fields.



During the summer, the Laboratory hires qualified undergraduate and graduate students to work in physics, engineering, mathematics, chemistry, biology, computer science, computer graphics, and materials science.

Professional Development and Benefits

Many opportunities for training and professional development, both formal and informal, exist at the Laboratory. Some of these special programs provide tuition assistance for career development, graduate thesis support, and self-study programs through the Learning Resources Center. The Laboratory also offers nearly three hundred courses each year in technical management, communication, and office administration fields to enhance and upgrade employee skills.

Regular full-time and part-time employees are eligible for a comprehensive benefits program that includes a variety of health and life insurance plans, a retirement program, and a liberal sick and vacation policy. Regular full-time employees earn two days of vacation each month, in addition to receiving eleven paid holidays yearly.

The Laboratory's Wellness Center provides employees with numerous health and fitness programs. The Center offers health programs in weight management, cholesterol reduction, smoking cessation, and stress management. Exercise programs include aerobic and conditioning classes in addition to classes on how to get started, stretch, and use aerobic weight training equipment. The center maintains fitness equipment at its main center and in twenty-eight outlying sites.

For information about employment at Los Alamos, contact:

Employment Group
Mail Stop P209
Los Alamos National Laboratory
Los Alamos, NM 87545
505/667-8622

Special Employment Programs and Opportunities

The Laboratory offers a variety of special employment programs to meet specific Laboratory needs and goals. Individual programs and opportunities are available for undergraduates, graduate students, recent recipients of Ph.D. degrees in science, service academy cadets and officers, and scientists who have achieved stature in their fields.

The Undergraduate Student Program offers summer and part-time work experience for students from all over the United States. The Graduate Research Assistant Program provides students with relevant research experience while they are pursuing graduate degrees. Postdoctoral Research Appointments are available for distinguished Ph.D. recipients who want to pursue creative scientific research.

Additional programs include the GEM Fellowship Program for minority students pursuing a master's degree in engineering or the natural sciences; the University Cooperative Program, which alternates six months of work and school for New Mexico undergraduates studying science, mathematics, engineering, technical writing, or accounting; and the Historically Black Colleges and Universities Program, which prepares graduates and undergraduates for science-related careers by providing them with work opportunities at the Laboratory.

Other opportunities enhance the Laboratory's interaction with industry and the academic community. Some participants come to the Laboratory for specific assignments on short-term appointments; others do research using unique Laboratory resources and user facilities, such as the Van de Graaff accelerator, Omega West research reactor, and LAMPF.

Information on the above special programs and opportunities may be obtained from:

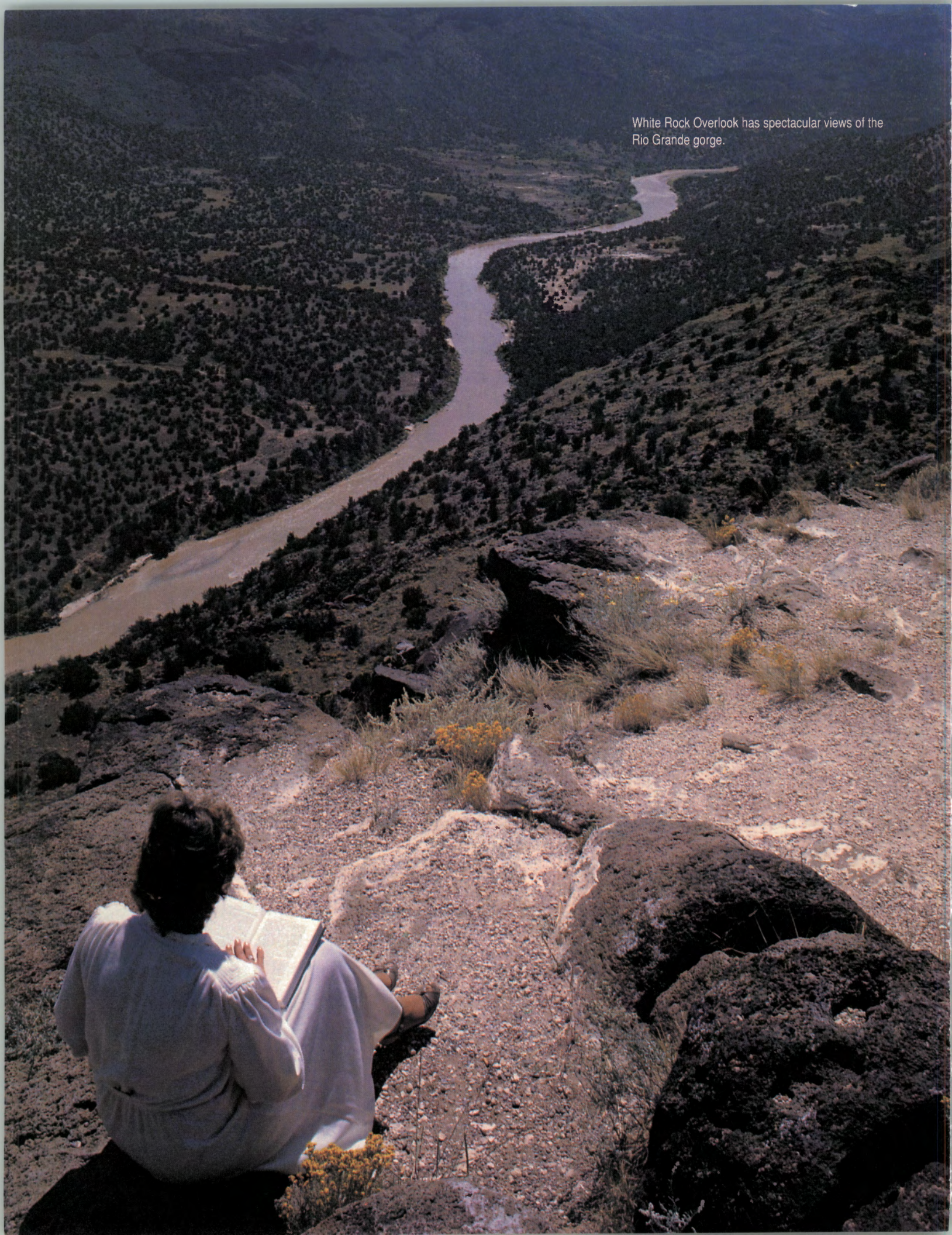
Special Employment Programs
Mail Stop P290
Los Alamos National Laboratory
Los Alamos, NM 87545
505/667-4536

SCIENCE IN A NATURAL SETTING

The natural beauty of Los Alamos includes snow-capped mountains, pinon and ponderosa pine, blue skies, and sweeping vistas. The climate offers cool summer days, enough snow in winter for downhill and cross-country skiing, and sunshine all year. Daytime high temperatures average seventy-two degrees from April through September and forty-seven degrees from October through March. Average humidity is 40 percent and total annual precipitation is about eighteen inches. Snowfalls can be heavy, with a total of fifty inches each winter, but the snow melts quickly, leaving most streets and sidewalks clear within a few days.

Pajarito Mountain Ski Hill, owned and operated by a volunteer group of residents, is located five miles west of the town. It has four chair lifts and more than thirty-five runs, the majority suitable for intermediate skiers, and receives an average annual snowfall of one hundred fifty inches. Many cross-country ski trails are nearby.

Clear mountain air and bright, sunny days encourage a variety of outdoor activities. Hiking trails abound for both the casual stroller and the avid backpacker. Fishing is permitted in nearby streams of the Jemez mountains or close to town at Los Alamos reservoir, a favorite place for children. Hunters can find an abundance of game in season.



White Rock Overlook has spectacular views of the Rio Grande gorge.

The Larry R. Walkup Aquatic Center is one of many recreation spots in Los Alamos.

Santa Fe Baldy in the Pecos Wilderness is a challenging peak for hikers and backpackers.

Both recreational and competitive bicyclists are active, taking advantage of the beautiful scenery and challenging terrain. Runners and joggers appreciate the canyon and forest trails and the local track. In addition, five exercise par courses—one in Los Alamos, one in White Rock, and three on Laboratory property—offer graded exercise.

Los Alamos County maintains an eighteen-hole golf course, an Olympic-size swimming pool, and several county parks, with ball fields, tennis courts, picnic areas, and playgrounds.

Both cross-country and downhill skiing are within easy reach of Los Alamos.

Fuller Lodge, once part of the Los Alamos Ranch School, is a national historic landmark.

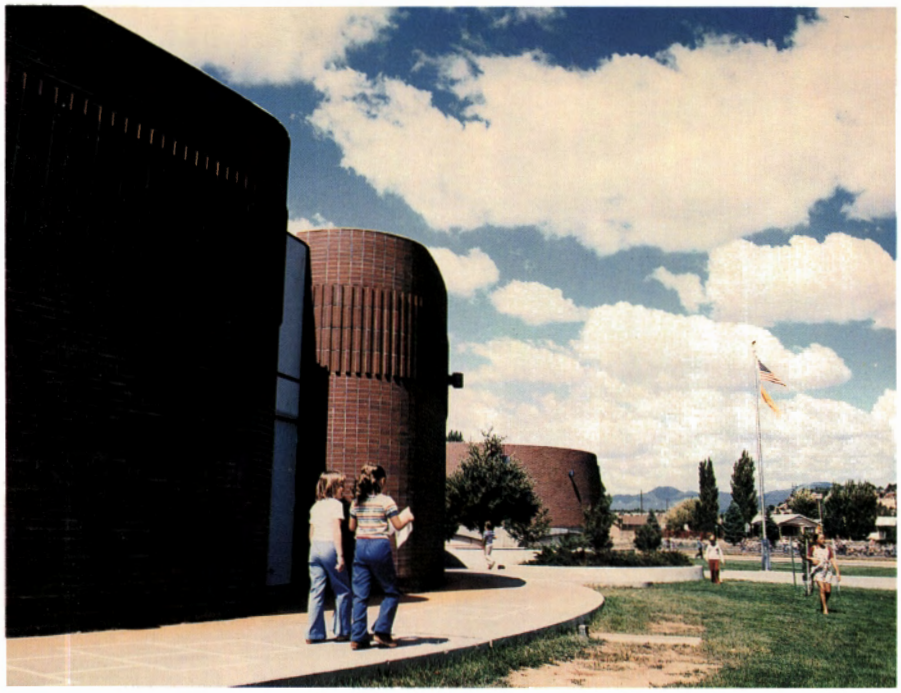
Ashley Pond in downtown Los Alamos commemorates Mr. Ashley Pond, founder of Los Alamos Ranch School.

The Community

Most of the eighteen thousand Los Alamos community members have come from other cities and states to make their homes in Los Alamos. There are two distinct areas of Los Alamos: the townsite, called "The Hill," and White Rock, a satellite community located ten miles away. The Hill, at an elevation of 7,150 feet, has eleven thousand residents. White Rock, at 6,900 feet, has about seven thousand residents.

Until 1957 Los Alamos was a closed community with strict security controls on residents and visitors. Everything was federally owned, from houses to utilities. Now all residential property is privately owned, and Los Alamos County owns and operates most of the community services and assets.

Most Los Alamos residents are Laboratory or contractor employees and their families. About 60 percent of the total Laboratory work force lives in the community. The rest commute from Espanola, twenty miles north of Los Alamos; Santa Fe, thirty-four miles southeast; and other communities within a hundred-mile radius of the Laboratory.



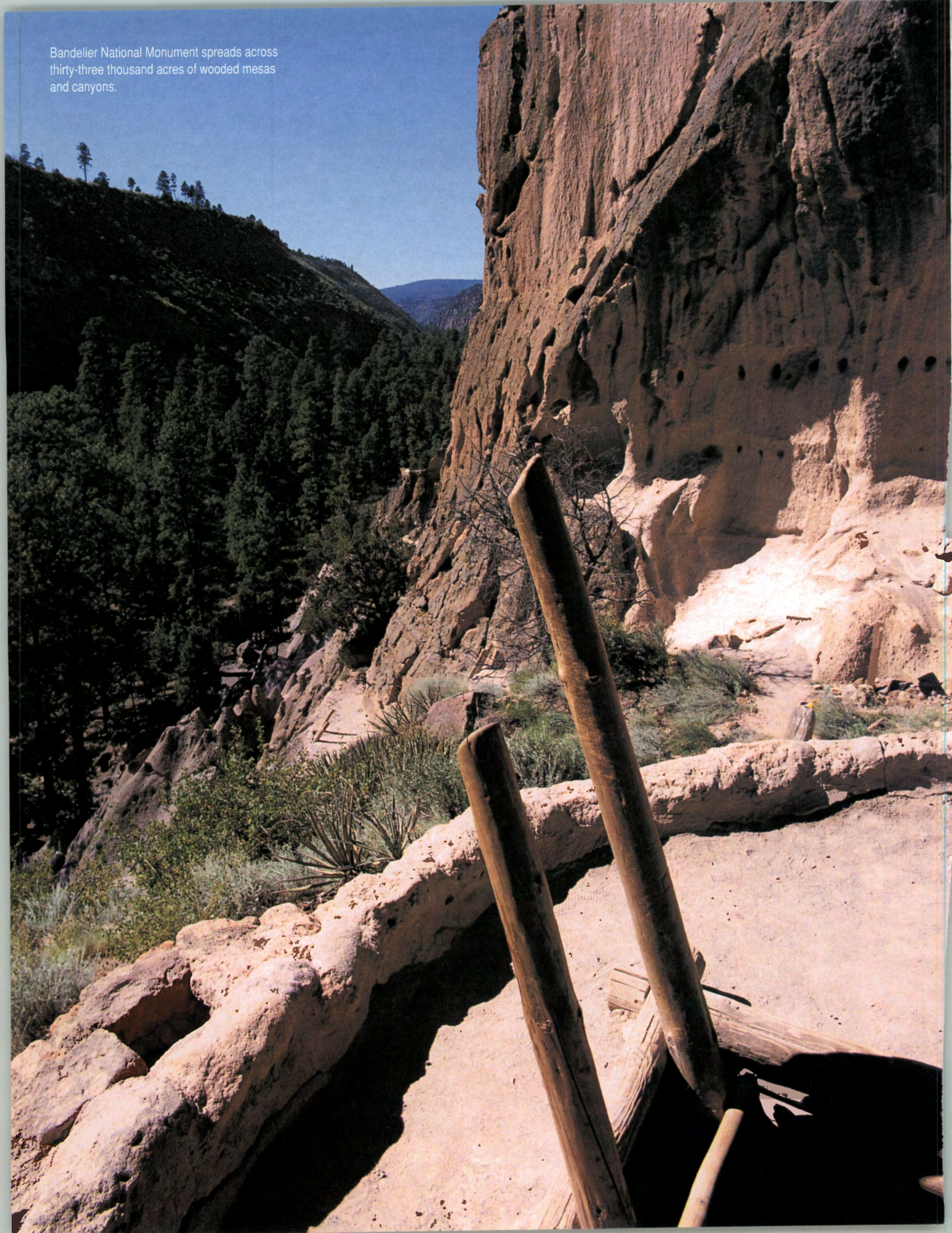
Chamisa Elementary School in White Rock is one of seven schools in the county.

Schools

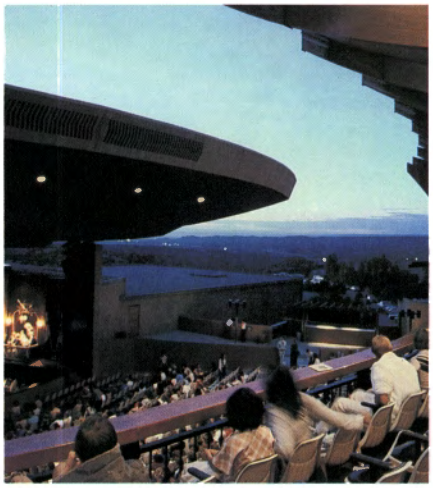
The Los Alamos school system has a nationwide reputation for excellence. Each year an average of fifteen Los Alamos High School students become National Merit Finalists—from a school population that could be expected to have two or three finalists. The strength of the schools' academic program is also demonstrated in standardized test results; each year Los Alamos students score well above national and state averages.

Almost thirty-five hundred students are in the public school system; the pupil/teacher ratio for all grades is about seventeen to one; and the county spends nearly five thousand dollars annually per pupil. With an average of almost sixteen years of schooling, Los Alamos residents have the highest educational level in the nation, according to the U.S. Census Bureau.

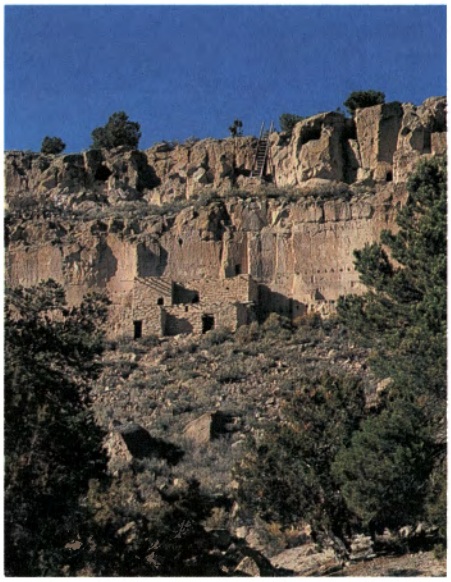
Through its branch campus and Center for Graduate Studies, the University of New Mexico brings a variety of educational opportunities to Los Alamos.



Bandelier National Monument spreads across thirty-three thousand acres of wooded mesas and canyons.



An alumnus of Los Alamos Ranch School founded the renowned Santa Fe Opera in 1957. The present opera house was constructed after a fire destroyed the original structure in 1967.



At Puye, an excellent example of ancient Pajaritan culture, anthropologists have unearthed stone houses, cliff dwellings, sanctuaries, anthropomorphic idols, pictographs, implements, and utensils.

Today Fuller Lodge, once the mess hall for Los Alamos Ranch School, is used for community and cultural events.

Attractions and Special Events

Los Alamos, just thirty-four miles from the historic state capital of Santa Fe and a convenient two-hour drive from Albuquerque or Taos, is close to many of northern New Mexico's most popular attractions:

- cultural events and museums
- prehistoric Indian ruins
- modern Indian pueblos
- a million-year-old collapsed volcano, the Valle Grande
- many outdoor sports and spectacular mountain scenery

For more than three decades the Santa Fe Opera has performed classical operas and world premieres under the stars. Another world-class musical event, the Santa Fe Chamber Music Festival, was founded seventeen years ago to ensure the performance of great music in Santa Fe. Their seasons run from July through August.

Bandelier National Monument, operated by the National Park Service, is a well-known archeological attraction. Located in Frijoles Canyon, five miles from White Rock, the monument includes Indian ruins from the fourteenth century. Some cliff dwellings in the soft volcanic rock have been restored, and a partially reconstructed pueblo sits beside a stream lined with cottonwoods. Museum pamphlets and guided trails describe ancient Indian life and environmental resources.

The history of Los Alamos is depicted at the Historical Museum located downtown in the Fuller Lodge Cultural Center. The museum offers local historical archives, exhibits, programs, and tours. Ruins of a prehistoric Indian pueblo are nearby, and a self-guided historical walk through the townsite begins at Fuller Lodge.

N1068R

High school students and their teachers practice stress-reduction exercises during an International Edison Day Symposium.

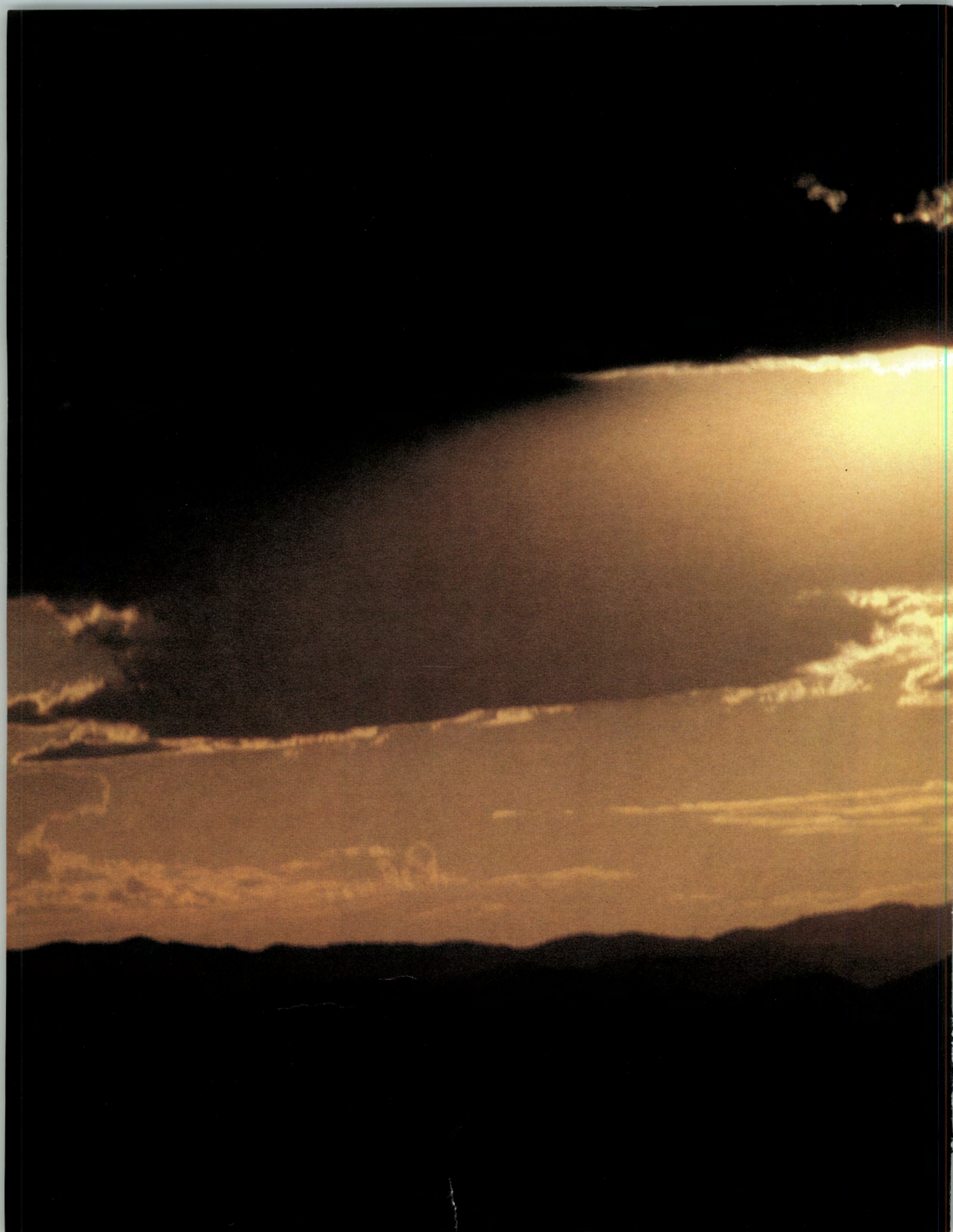
The Albuquerque International Balloon Fiesta is an annual fall event.

Just inside the entrance to Bradbury Science Museum, a life-sized plaster cast of J. Robert Oppenheimer, the Laboratory's first director, stands in front of a display of World War II memorabilia.

The Bradbury Science Museum, operated by the Laboratory, presents Laboratory research activities and history. Exhibits range from the history of the wartime Manhattan Project to current Laboratory research.

Sports fans enjoy annual athletic events in Los Alamos, such as the high-altitude mini-marathon, the Tour de Los Alamos bicycle race, and the nation's oldest ongoing triathlon, which combines bicycling, running, and swimming. Another highlight is the annual women's run, geared to all levels and designed for fun and health. For golfers, the Atomic City Invitational Tournament attracts players from the entire Southwest. Skiesta, held the last day of each ski season, features races and other events.

The county arts festival in August combines musical events, dance, films, and an arts and crafts fair. Other arts and crafts fairs are held in spring and fall; all display the best work of artisans from Los Alamos and surrounding communities in northern New Mexico. August is also county fair and rodeo time, when the flavor of the West permeates Los Alamos.



Challenge and Discovery in the Future

Los Alamos is part of a proud scientific tradition. Our community and natural setting are unique, and opportunities—both professional and personal—abound. Most important, we know that our efforts can make a positive difference in the world.

LALP-89-49
July 1990

Produced by the Information Services Division

Designed by James M. Cruz
Edited by Diane D. Norton
Printing coordination by Guadalupe D. Archuleta

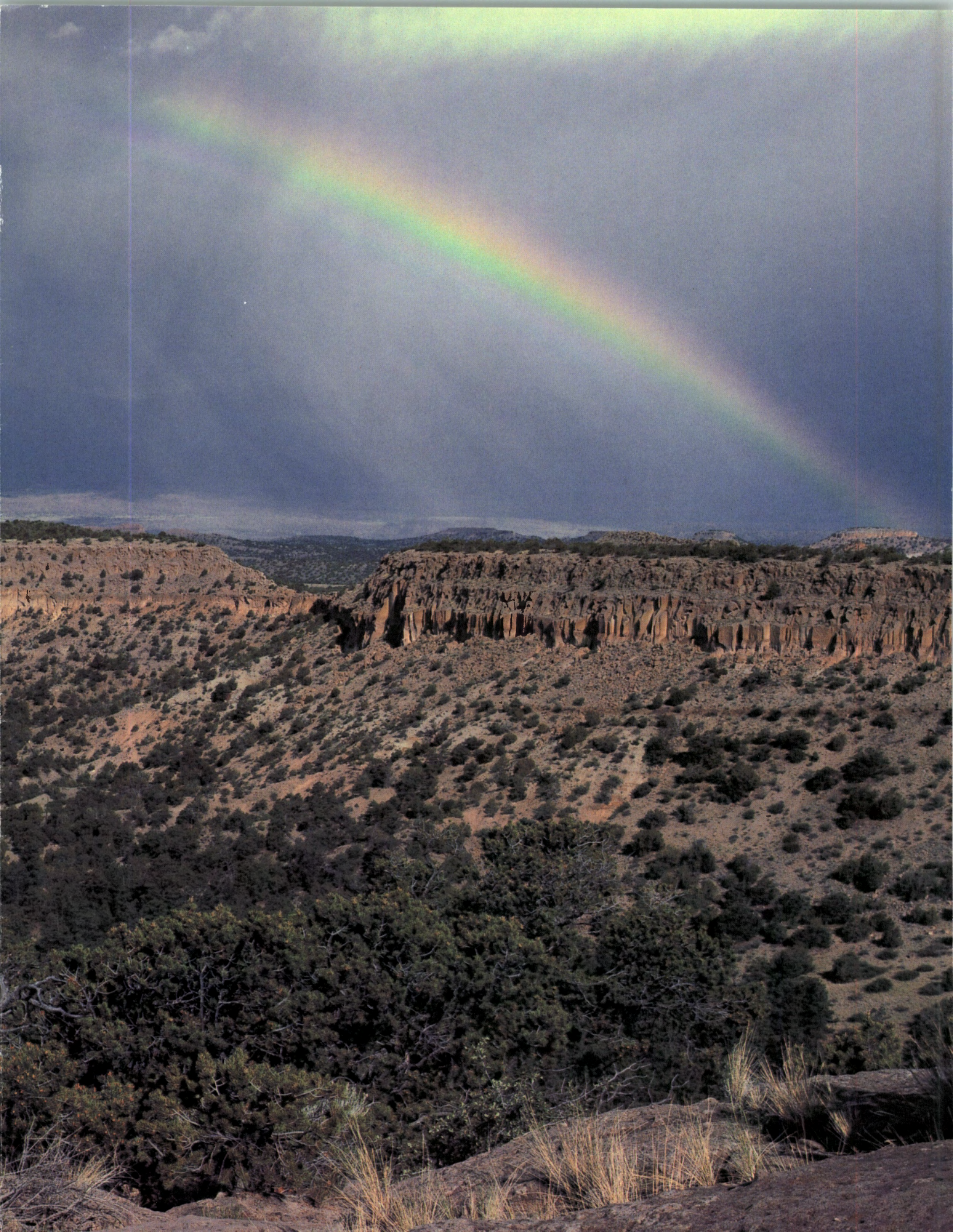
Photography and illustration credits
front cover: C. Lindberg (landscape), L. Sanchez (laser); **page 1:** NASA (Earth); **page 2:** Woodfin & Assoc., J. Karsh (Oppenheimer); **page 4:** H. Ortega (bright source laser); **page 5:** H. Ortega (boron carbide), Cray Research, Inc. (Cray), P. Sanford (aerospace plane); **page 7:** L. Sanchez (BEAR), C. Wood (neural processing); **page 8:** J. Ulibarri (rack); **page 9:** J. Ulibarri (earth penetrator), D. MacBryde (flags); **page 10:** Sandia National Laboratories (nose cone test); **page 11:** J. Fowler (computer submarine, computer design code test); **page 12:** H. Ortega (cloud chamber); **page 13:** H. Ortega (FEL laser), J. Messimer (GTA), B. Pena (grazing laser); **page 14:** J. Halliday (tank); **page 16:** J. Tubb (global positioning satellite); **page 17:** F. Rick (ZT-40M); **page 18:** L. Sanchez (Fenton Hill); **page 19:** Smith & Associates, J. Segler (St. Lucia); **page 20:** H. Ortega (pulsed laser); **page 21:** E. Johnson (infrared detector), M. Prueitt (superstrong polymers); **page 22:** B. Martin (Omega West reactor); **page 23:** A. Garcia (blue light plume); **page 24:** P. Jackson (jimsonweed); **page 25:** T. Yamada, S. Bunker, M. Prueitt (pollution model), J. Cruz (cosmic strings); **page 26:** K. Winkler (shock wave patterns); **page 27:** J. Meyne (DNA), Tech Reps Inc., B. Smith (brain illus.); **page 28:** NASA (Jupiter); **page 29:** H. Ortega (Connection Machine); **page 30:** K. Eggert, B. Travis, S. Chen, G. Doolen (oil recovery); **page 31:** H. Ortega (HTS oven); **page 32:** H. Ortega (LAMPF drift tube); **page 33:** H. Ortega (BGO ball), I. Worthington (Cockcroft-Walton), L. Sanchez (Study Center); **page 34:** J. Flower (students); **page 36:** L. Sanchez (specialist); **page 37:** L. Sanchez (student); **page 38:** J. Flower (mesas); **page 40:** Smith & Associates, M. Greenbank (Overlook); **page 41:** C. Lindberg (aquatic center), Smith & Associates, M. Greenbank (Santa Fe Baldy), F. Rick (ski basin); **page 42:** T. Velarde (Fuller Lodge); **page 43:** Smith & Associates, M. Greenbank (Ashley Pond, UNM), W. Regan (Chamisa Elementary); **page 44:** Smith & Associates, M. Greenbank (Bandelier); **page 45:** Santa Fe Opera, D. Stein (opera), Smith & Associates, J. Segler (Puye), M. Greenbank (Fuller Lodge); **page 46:** B. Pena (Balloon Fiesta); **page 47:** B. Pena (Edison Day), Smith & Associates, M. Greenbank (balloons, museum); **page 48:** Smith & Associates, M. Greenbank (sunset); **back cover:** L. Sanchez (laser)

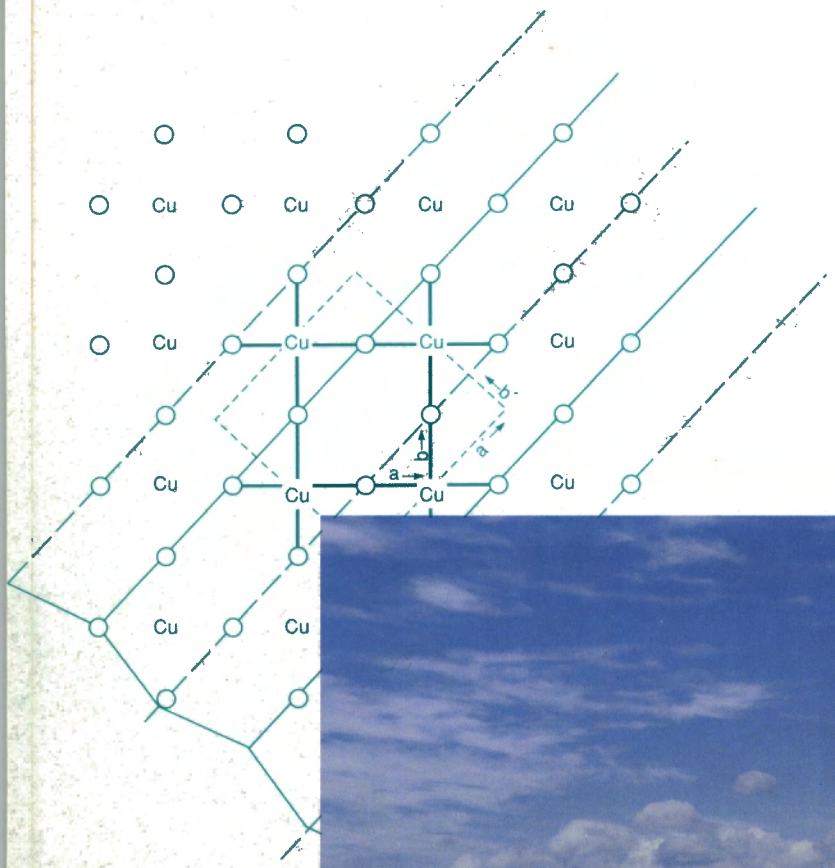
Los Alamos National Laboratory is managed under Contract No. W-7405-ENG-36 for the U.S. Department of Energy by the University of California. As a federal government contractor, the Laboratory is subject to executive orders and regulations pertaining to equal employment opportunity.

The Laboratory's equal employment opportunity policy requires, in accordance with applicable state and federal laws, Department of Energy policy, and University of California policy, concerted effort to ensure that the Laboratory does not discriminate. All policies, procedures, and practices are administered for all employees and applicants regardless of race, color, national origin, religion, sex, sexual orientation, handicap, age, veteran status, medical condition (as defined in Section 12926 of the California Government Code), ancestry, marital status, or citizenship, with the limits imposed by law or University of California policy. The Laboratory also undertakes affirmative action regarding women, minorities, individuals with handicaps, and covered veterans. This policy of nondiscrimination applies to recruiting, employment, compensation, benefits and services, training, advancement, promotion, transfer, termination, and the availability of both informal and formal complaint-resolution procedures.

Inquiries regarding the Laboratory's equal opportunity and affirmative action policies may be directed to the Affirmative Action/Equal Employment Opportunity Officer, Los Alamos National Laboratory, Los Alamos, New Mexico 87545, Telephone (505) 665-2117, (FTS) 855-2117.

This report was prepared as an account of work sponsored by the United States Government. Neither the United States, United States Department of Energy, nor any of their employees makes any warranty, expressed or implied, or assumes legal liability or responsibility for the accuracy, completeness, or usefulness or any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, mark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.





Los Alamos
NATIONAL LABORATORY

Los Alamos, New Mexico 87545