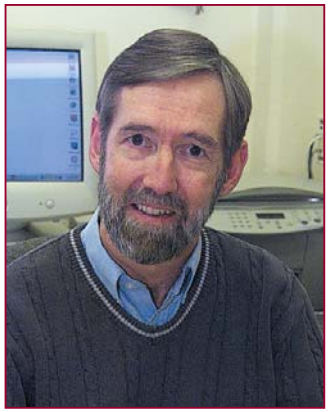
EES Division

Group and IGPP Overviews

ACRONYMS AND ABBREVIATIONS

ARM	Atmospheric Radiation Measurement
CAA	Contaminant Analysis Automation
CB	Carlsbad Operations
CBFO	Carlsbad Field Office (DOE)
CCF	Central Confirmation Facility
CEMRC	Carlsbad Environmental Monitoring & Research Center
DOE	Department of Energy
EES-2	Atmospheric, Climate, and Environmental Dynamics Group
EES-6	Hydrology, Geochemistry, and Geology Group
EES-7	Geotechnical Engineering Research
EES-9	Environmental Geology and Risk Analysis Group
EES-11	Geophysics Group
EES-12	Carlsbad Operations Group
EM-50	Environmental Management Office of Science and Technology
EMP	electromagnetic pulse
GGRL	Geochemistry and Geomaterials Research Laboratory
GIS	Geographic Information System
GISLab	Geographic Information System Laboratory
GPS	Global Positioning System
IGPP	Institute of Geophysics and Planetary Physics
LIDAR	Light Detection and Ranging
LQS	large-quantity sites
NASA	National Aeronautic and Space Administration
RCRA	Resource Conservation and Recovery Act
SODAR	Sound, Distance, and Ranging
SQS	small-quantity sites
TRU	transuranic
WIPP	Waste Isolation Pilot Plant
ZECA	Zero Emission Coal Alliance

Earth and Environmental Sciences Division Management



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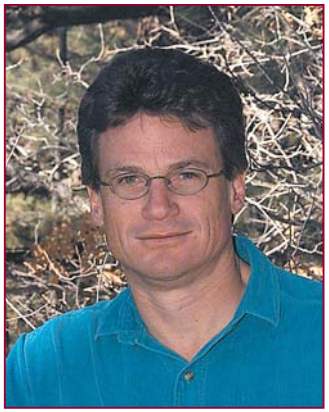

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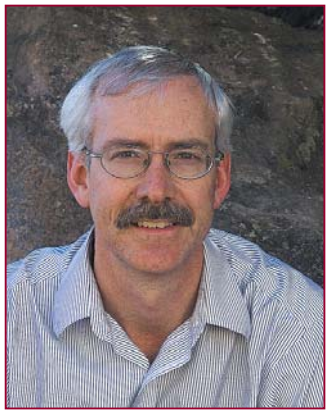

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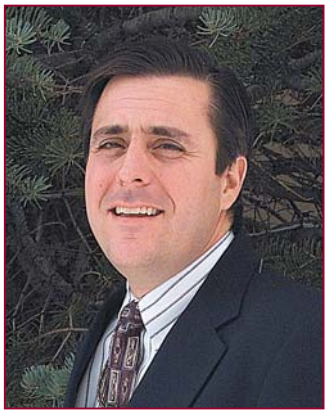

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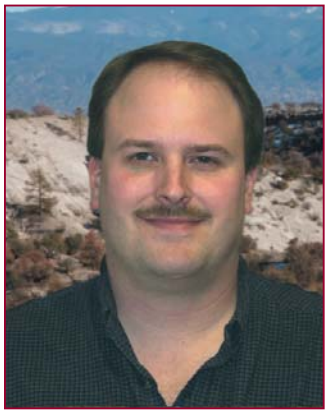

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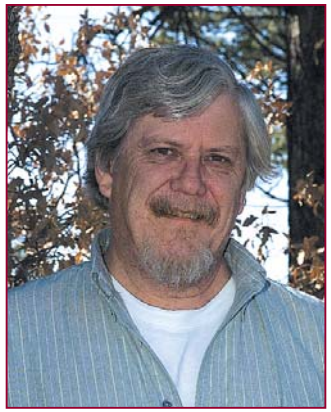

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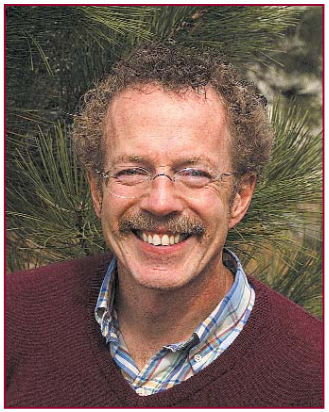

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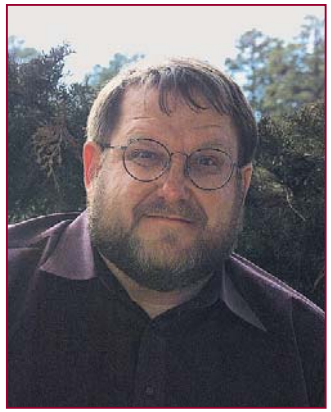

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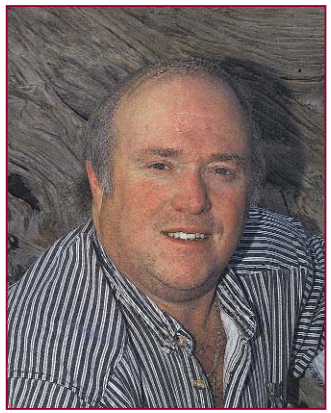

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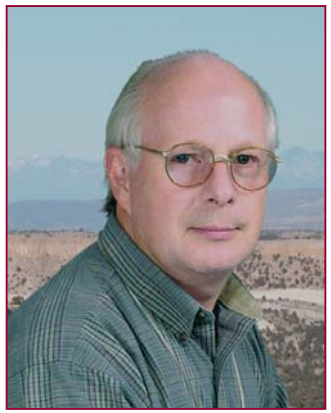

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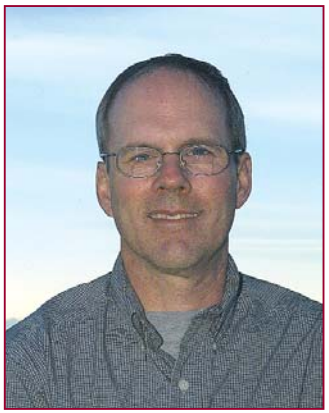
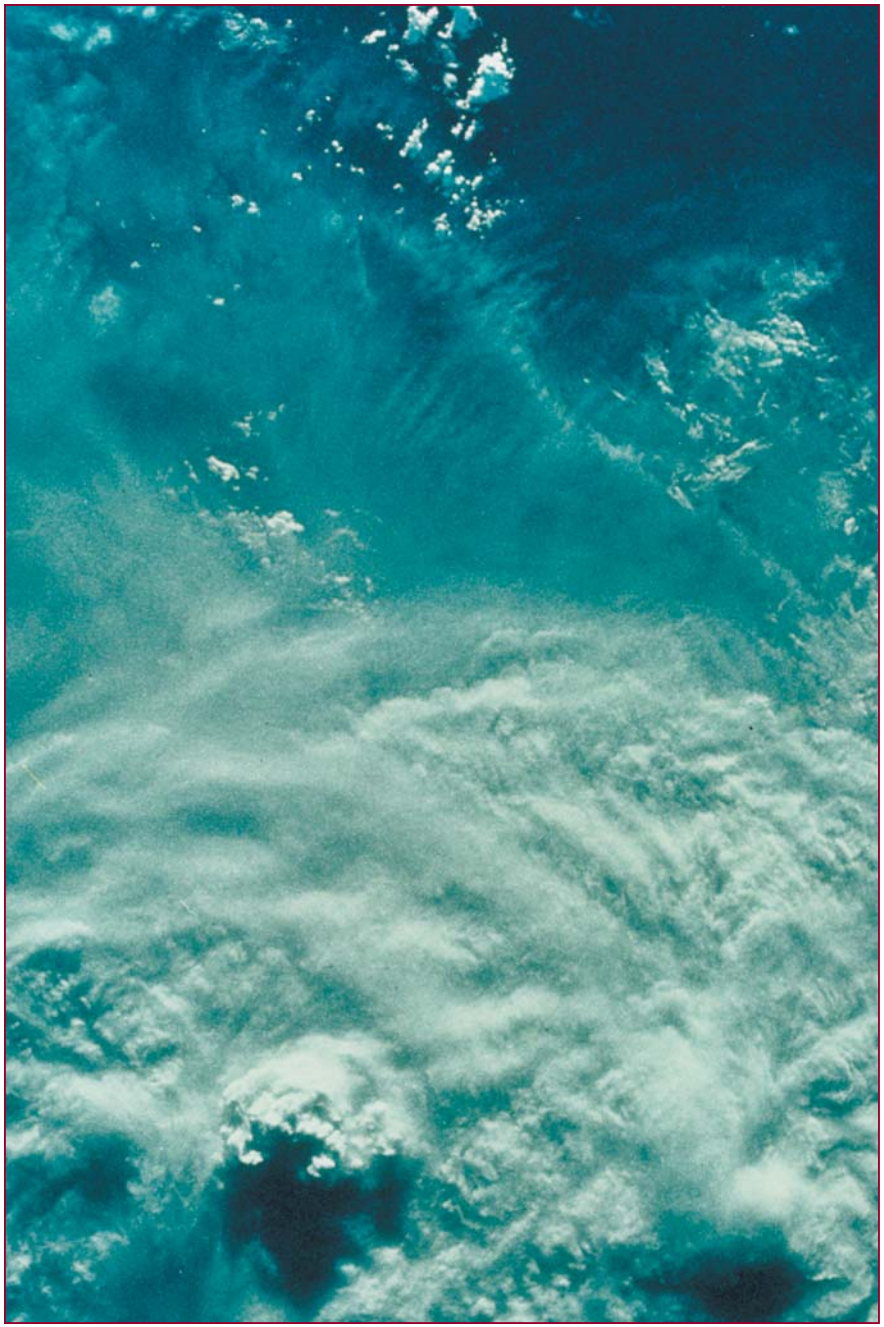


Atmospheric, Climate, and Environmental Dynamics—EES-2



ABOUT EES-2

The technical capability within EES-2 represents a critical and specific portion of Los Alamos' expertise in the earth and environmental sciences. The group's staff embodies most of the Laboratory's research and development in the atmospheric sciences, ground surface exchange processes, terrestrial ecology, and hydrology. To ensure outstanding performance in these disciplines, EES-2 has on staff experts in instrumentation deployment, measurement strategies, data analysis, and modeling and simulation. With these skills, we are uniquely qualified to investigate problems that encompass the Earth's life-sustaining biosphere. In addition, we do important national security work that requires an understanding of the physics of electromagnetic radiation propagation through the lower and upper atmospheres.

We view our future as providers of mission-relevant research for DOE, the National Nuclear Security Agency (NNSA), the Department of Homeland Security, and other agencies that focus upon the synergistic capabilities within our teams. By combining our technical expertise, we can deliver more comprehensive solutions that address the growing demand for integrated science-based assessments of environmental and national security problems.

Our expertise is organized into six capability teams. These are listed below, along with each team's particular areas of specialty.

Atmospheric Modeling. Microscale urban dispersion, wildfire behavior modeling, flows in complex terrain, explosions in ambient environments, hurricane intensity prediction, planetary circulations (Mars), numerical methods, high-performance computing techniques.

Climate and Ocean Modeling. Isopycnic and hybrid coordinate ocean model development, biogeochemistry and ocean carbon-cycle modeling, climate applications to high-performance computing systems.

Ecology. Semiarid systems ecology, theoretical ecology, soil science, carbon sequestration, micrometeoro-

logical instrumentation and analysis, biogeochemical aspects of environmental restoration research.

Hydrology. Coupled atmosphere, surface, subsurface modeling, water resource prediction, contaminant fate and transport, erosion, hydrologic aspects of environmental restoration research.

Tropical Western Pacific. Construction and maintenance and operation of meteorological instrumentation sites in tropical environments; management of foreign contracts, personnel, and maintenance teams; K-12 education; public outreach.

Weapons Phenomenology and Infrasound. Physics and chemistry of atmospheric composition, theory and modeling of electromagnetic radiation and its propagation through the Earth's atmosphere, interpretation of data recorded by satellites and infrasound ground sensors, signal processing.

EES-2 uses the capabilities of our technical teams for interdisciplinary research. Through continuous improvements in computing power and numerical methods, we have greatly increased our ability to explicitly simulate turbulent flows in regions of high temperature or pressure gradients such as those created by a wildfire. EES-2 has developed a wildfire-behavior-modeling capability using a full-physics combustion code in an advanced numerical turbulence model that provides fully interactive computations between wildfire and local weather. The model also simulates stochastic descriptions of flying embers and incorporates physical processes such as radiative preheating of fuels and smoke emissions.

Our ecological research encompasses populations and ecological risks as well as the dynamic response of ecosystems to human activities and changes in land use and climate. Present capabilities include studies of the potential for flood, hillslope erosion, sediment transport, and contaminant movement in areas affected by the Cerro Grande fire, which ravaged the Los Alamos area in May 2000. We have also investigated the interconnections between ecological and hydrological processes in northern New Mexico's piñon-juniper woodlands and ponderosa pine forests.

EES-2 researchers are studying climatic variability in the Rio Grande drainage basin, research that draws upon our knowledge of regional water cycles and incorporates coupled modeling of groundwater, surface and subsurface hydrology, and boundary-layer atmospheric physics. We also are developing new models to more accurately represent ocean circulation systems and are testing new algorithms for describing biogeochemistry cycles—carbon cycling, trace gas emissions, and climate feedbacks in global-ocean models.

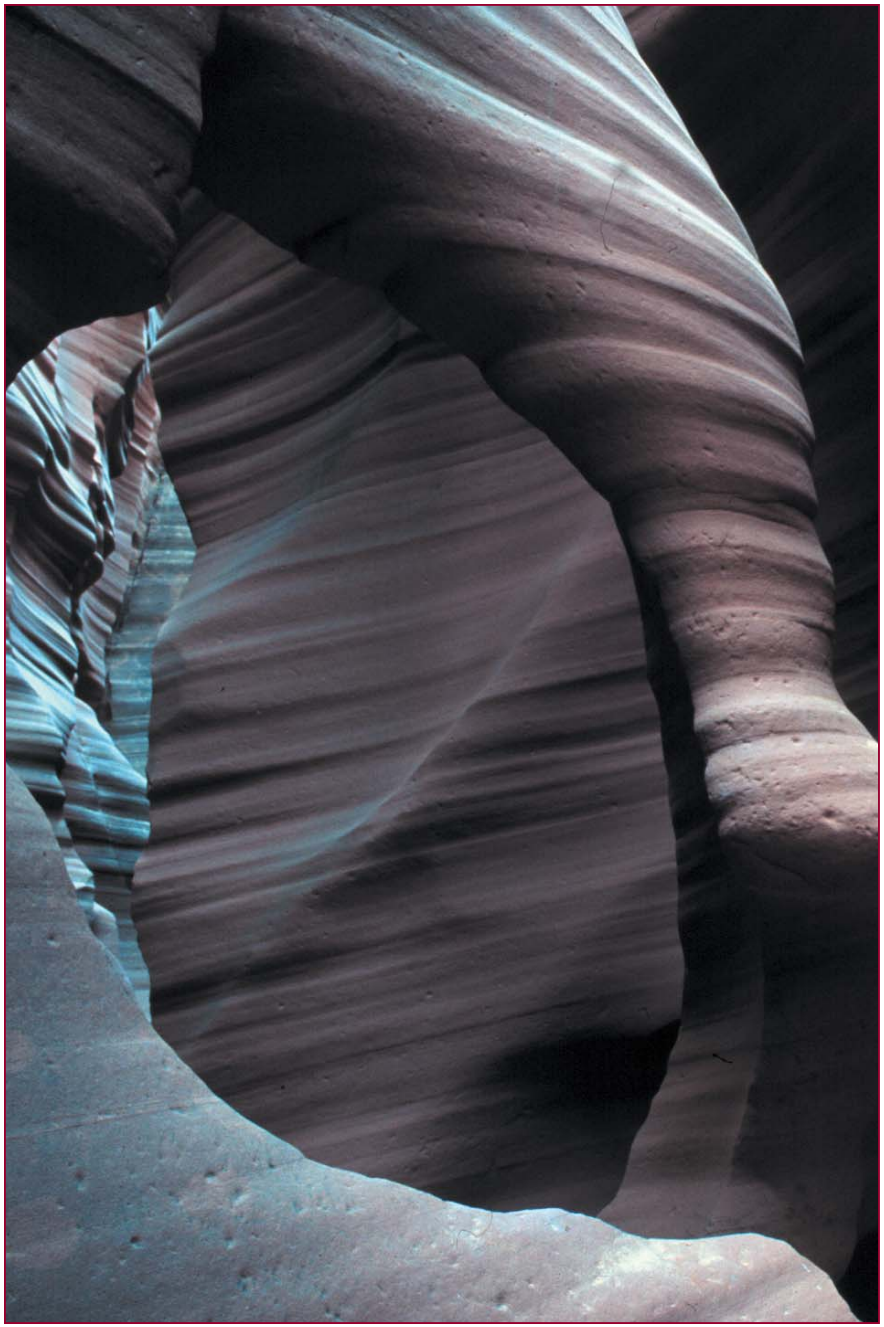
Los Alamos scientists have taken an interest in atmospheric electrification since the days of atmospheric nuclear testing. Some of the same processes associated with the propagation of electromagnetic pulses (EMP) by nuclear tests occur in thunderstorms and other natural processes. EMPs are potentially harmful to communications satellites. EES-2 is using advanced numerical models to investigate EMPs and upward electrical discharges—the "red sprites" and "blue jets" that airline pilots sometimes observe emanating from the tops of thunderclouds. We are also calculating the source region of optical, electromagnetic pulse, and infrasound radiation that is generated by nuclear explosions and natural phenomena such as meteors and lightning, which propagate through the atmosphere and are recorded by satellite and ground-based sensors.

EES-2 has considerable expertise in meteorological instrumentation, deployment and analysis of observational data. For DOE's Atmospheric Radiation Measurement (ARM) Program, which focuses on the role clouds play in modifying solar and terrestrial radiation and climate, EES-2's Tropical Western Pacific Program Office has developed three remote research stations on tropical atolls in the equatorial western Pacific Basin and at Darwin, Australia. These remote stations constitute one of three ARM sites worldwide and provide continuous monitoring of the tropical climate system. The group maintains other instrumentation platforms for a variety of field measurement requirements, including remote sensing with LIDAR, radar, and SODAR. The measurements provided by our Raman LIDAR are a powerful tool for understanding the behavior of the atmosphere's surface layer and its interactions with underlying vegetation and other features of the Earth's surface. We have also established a Luminescence Geochronology Laboratory to study optically stimulated luminescence in quartz and feldspar.

Capabilities

- Atmospheric and oceanic circulation
- Atmospheric radiation measurements
- Infrasonic detection of atmospheric events
- Urban dispersion
- Measurement systems for remote, hostile environments
- Wildfire behavior
- Ocean biogeochemistry
- Surface and soil-water hydrology
- Geomorphology and geochemistry
- Ecology of semiarid woodlands and forests
- Ecological risk assessment
- Soil science ■

Hydrology, Geochemistry, and Geology—EES-6



ABOUT EES-6

Yucca Mountain, a high ridge in the southern Nevada desert composed of ancient volcanic ash layers, is a potential site for the permanent underground disposal of high-level radioactive waste. The next step is approval by the US Nuclear Regulatory Commission of a license application that the DOE will submit in December 2004. For the license application to be successful, DOE must demonstrate that there will be minimal risk of radioactive contamination to surrounding populations for the next ten thousand years.

How can we be confident about repository performance over such a long period into the future? The answer lies in a multiple-barrier approach. Any leaking radioactive contamination would have to migrate through the walls of its container, through a 300-meter-thick unsaturated zone to the water table, and then through the water table for many kilometers until it reaches a human who might pump the water for drinking and irrigation. Each one of these steps serves as a barrier in which chemical interactions between the contamination and surrounding rocks and mixing with clean groundwater may reduce the dose to which humans might be exposed.

Los Alamos National Laboratory's Hydrology, Geochemistry, and Geology Group is using field geologic observations along with advanced experimental and computational approaches to characterize parts of these barriers and to help predict the risk to people who might live close to Yucca Mountain in the future.

Similar approaches are taken by the group to reduce excess CO_2 in the atmosphere, to solve legacy environmental issues at Los Alamos and other DOE sites, and to explore the evolution of planets and the origin of life.

Vision

Our vision is to apply cutting-edge integrated experimental, computational modeling, and observational studies to complex problems involving subsurface flow and transport, geomaterials, geochemistry, and geology. We will apply these approaches to help solve environmental, energy, and defense-related problems.

Capabilities

The group's computational, experimental, and observational approaches underpin major capabilities in

- Geology
- Geochemistry
- Earth and planetary materials
- Subsurface flow and transport
- Self-organizing systems.

The Geochemistry and Geomaterials Research Laboratory (GGRL) is the centerpiece of the group's experimental and analytical research effort. GGRL houses

- A light-stable isotope mass spectrometer
- An electron microprobe
- A scanning electron microscope
- An x-ray fluorescence spectrometer
- An inductively coupled plasma mass spectrometer
- Gas chromatographs
- X-ray diffractometers
- An autoclave.

The GGRL is used for a variety of experiments such as colloidal transport, capture of CO_2 from air, and thermal stability of minerals.

Major basic and applied science programs that use our capabilities include the following:

Transport of Contaminants in Saturated and Unsaturated Hydrologic Systems. Los Alamos develops geologic, geochemical, and hydrologic framework models for contaminated sites, based on field observations, experimental geochemical laboratory investigations, and analytical studies. Interactions between contaminants and the rocks at these sites are determined, resulting in parameters that are incorporated into high-fidelity predictive models. Model results allow cost-effective planning for mitigation or cleanup of contaminated sites, as well as for the performance of long-term repositories such as the potential Yucca Mountain radioactive waste repository.

CO_2 Sequestration. Our scientists are involved in efforts to minimize the climate impacts of CO_2 derived from combustion of fossil fuels. One approach we are developing to reduce the amount of carbon dioxide in the Earth's atmosphere is injecting the CO_2 deep into the ground instead of releasing it into the air from power plants and other sources. EES-6 researchers are applying geologic, rock-fluid interaction, and stochastic fluid flow expertise to determine the best methods of geologic sequestration. We also are studying the removal of dispersed CO_2 from the air using novel geochemical processes.

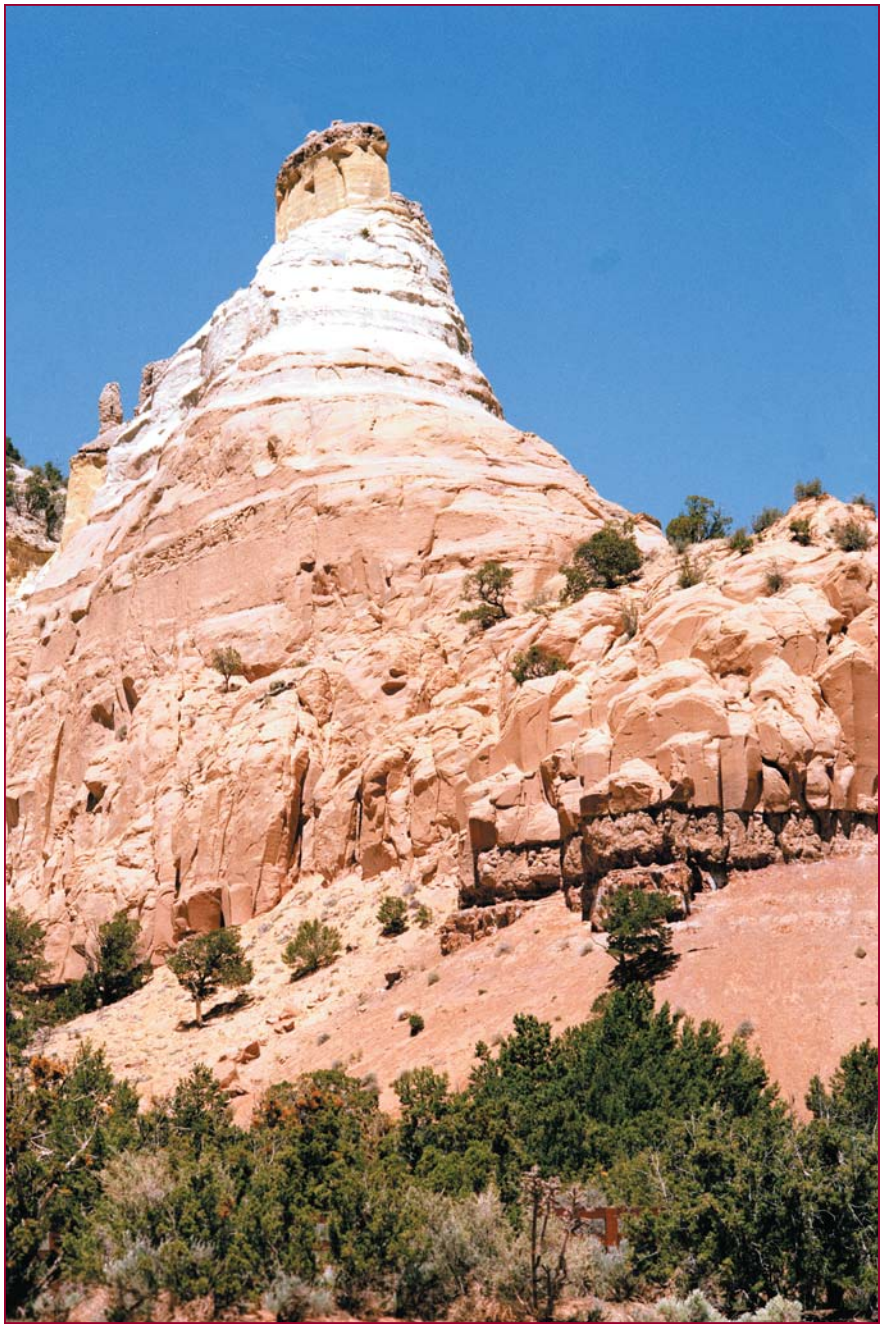
Basin-Scale Hydrology. We apply our understanding of geochemistry and geology to the development of conceptual models for groundwater basins such as the Española Basin in northern New Mexico. Using specially developed computational grids that honor the three-dimensional complexity of the basins, we then use numerical models to explore different scenarios for water usage and potential contamination.

Zero-Emission Coal Technology. Created and spearheaded by Los Alamos, the Zero Emission Coal Alliance has grown into an organization comprised of groups involved in coal production and the use of coal in electrical generation in the US and Canada. Zero-emission coal technology supports the DOE's Clean Coal Technology vision and programs. Alliance affiliates are planning to launch a pilot study by 2007, and, eventually, to commercialize the technology.

Volcanic Geology and Hazards. EES-6 scientists, along with researchers in other groups, comprise one of the nation's largest concentrations of expertise in volcanic processes and geology. We are currently applying this expertise to expand our knowledge about the Nevada Test Site (which is dedicated to underground nuclear test readiness) and to determine the risks associated with volcanism at or near the potential Yucca Mountain repository. Our scientists also participate in a joint Los Alamos–University of New Mexico graduate program in volcanology.

Planetary Geology and Astrobiology. We are applying our knowledge of geologic materials and hydrology to address the history of water on Mars and potential implications for the development of life on that planet. We also are using both theoretical and experimental approaches to study self-organizing processes that may form the link between nonliving and living matter. ■

Geotechnical Engineering Research—EES-7



ABOUT EES-7

In July 2002, after 24 years of scientific studies—much of which Los Alamos researchers have headed—Congress accepted DOE's recommendation to prepare a license application for Yucca Mountain to be the nation's first long-term geologic repository for spent nuclear fuel and high-level radioactive waste. The site, located approximately 100 miles northwest of Las Vegas in Nye County, Nevada, has become one of our Laboratory's primary geotechnical research areas.

Core science data collection and long-duration testing results from the Yucca Mountain Project have provided a scientific basis for the repository's site recommendation. Our geotechnical staff is coordinating and integrating testing activities throughout excavation. Los Alamos also is helping to ensure that continuity is maintained from design and construction through testing.

Assessing Yucca Mountain requires the skill and knowledge base of a multidisciplinary team of physical scientists. Physicists, chemists, geologists, engineers, technicians, and general staff from Los Alamos National Laboratory apply their knowledge and tools, supported by the parallel work of scientists representing other national laboratories, universities, and the US Geological Survey.

At Yucca Mountain, we are applying our geotechnical engineering capabilities, which include

- Geology
- Hydrology
- Geophysics and seismology
- Technical leadership and management.

For any repository, the foremost concern is the potential of transport of the gradually disintegrating wastes to the accessible environment. Normally, the transporting agent would be groundwater. At Yucca Mountain, however, because of the region's volcanic nature, concerns are compounded by the possibility of a future reoccurrence of tectonic activity. In the southern Nevada desert near the California state line, an earthquake or volcanic eruption could conceivably generate a radionuclide transport mechanism.

The major tests and facilities at the repository site are

Exploratory Studies Facility. Excavation of the tunnel, which is approximately 8 km long and 7.5 m in diameter, required four years of drilling and used a tunnel-boring machine. During the construction and testing phases, Laboratory responsibilities include coordinating design, construction, and testing, so that staff can conduct complex testing activities in a construction environment.

Drift-Scale Test. The Drift-Scale Test is a large-scale, in situ thermal test that we are conducting in the Exploratory Studies Facility over a 10-year period. For this test, our overall objective is to acquire an in-depth understanding of the thermal, mechanical, hydrological, and chemical processes that occur in all rock formations. This knowledge is crucial, because at Yucca Mountain the heat of decaying radioactive waste can be expected to intensify these processes. An understanding of the interaction of these processes is essential to our assessment of the repository's long-term performance.

Enhanced Characterization of the Repository Block. Enhanced characterization studies include

- Construction and testing in the cross drift
- Monitoring drift convergence
- Mapping geologic features
- Collecting rock samples
- Coring
- Logging
- Instrumentation of boreholes to monitor moisture penetration in the rock mass
- Hydrologic and thermal testing in alcoves and niches.

Surface-Based Drilling and Coring. In order to analyze natural processes under ambient conditions, researchers are collecting data from hydrologic, geologic, and geochemical studies. Surface-based testing is performed primarily in boreholes but also includes surface pits and trenches, outcrop mapping, and seismic monitoring.

Underground Transport Test Facility. Project staff have designed and constructed a test facility approximately 8 km southeast of the Nevada Test Site repository area at Busted Butte. Using electrical resistance tomography, ground-penetrating radar, neutron logging, and tracer injection tests, we are investigating the properties and behavior of the unsaturated zone at Busted Butte in order to determine flow and transport properties of rocks below the proposed repository horizon. ■

Environmental Geology and Risk Analysis—EES-9

ABOUT EES-9

EES Division's Environmental Geology and Risk Analysis Group focuses on the study of uncertainties associated with complex natural environmental systems and finding solutions to problems that arise as the result of human activities.

Capabilities

The group's capabilities include

- Volcanic and seismic hazards
- Geomorphology and surface processes
- Geochemistry
- Geographic information systems
- Environmental modeling and risk assessment
- Quality assurance and data validation.

Our technical and decision support capabilities are often applied within the context of regulatory policy. We are currently applying our probabilistic risk and decision analysis tools to the following projects:

Yucca Mountain Project. The Laboratory is investigating volcanism and erosion hazards that could emerge in the geological future of the Yucca Mountain repository. The EES-9 Group is responsible for the project's quality assurance program, including reviewing and verifying the research process from initial experiments to final reports, and ensuring the integration of technical investigation documentation.

Environmental Restoration Project. Our Environmental Restoration Team is evaluating present-day human health and ecological risks from contaminants that entered certain areas of the Los Alamos ecosystem during the early days of the research complex. Our restoration research focuses on laboratory land known as the Canyons Focus Area. Field studies also are assessing the possible future impact of the transport of the legacy contaminants down the canyons to areas beyond Laboratory property.

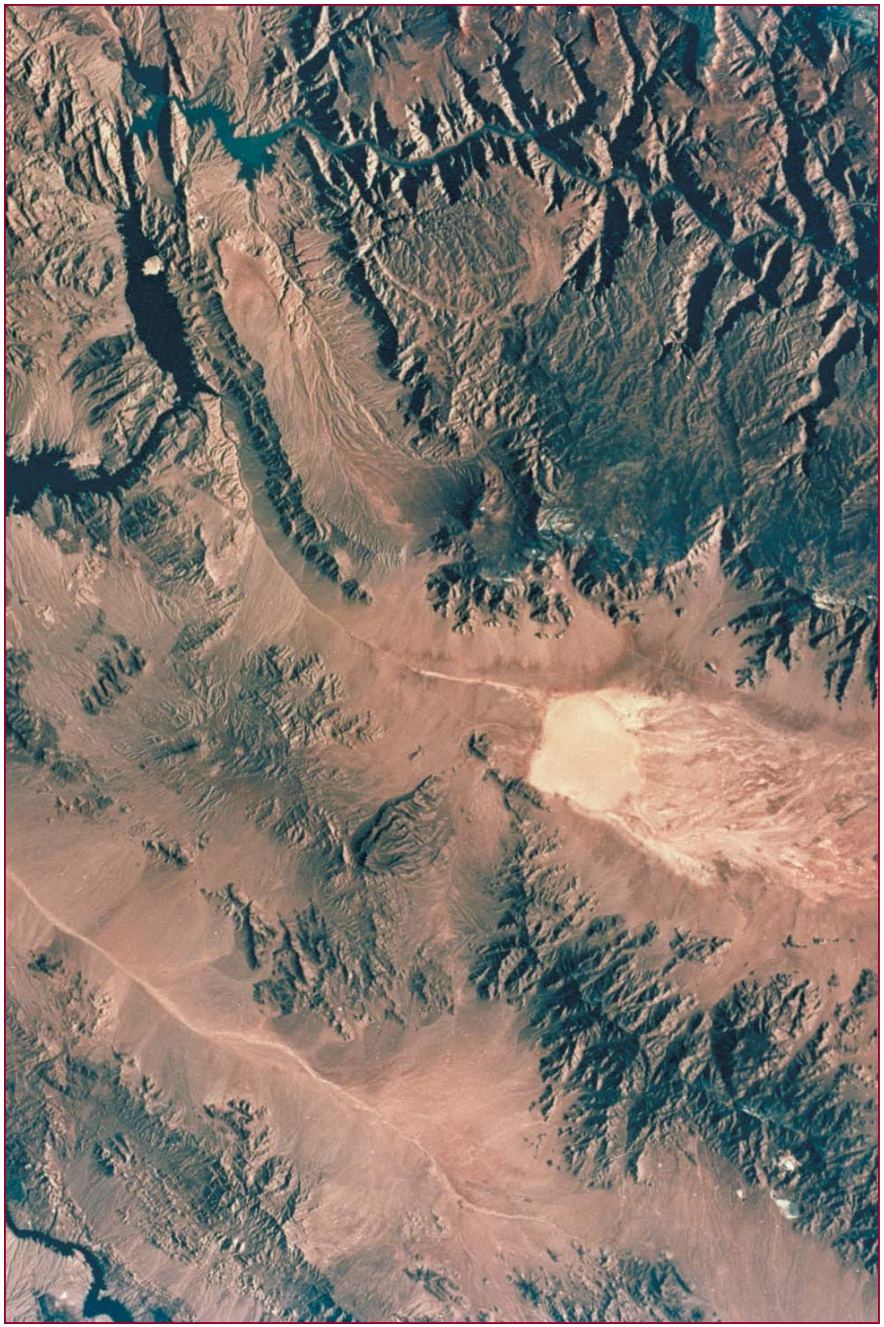
Geographic Information System Laboratory (GISLab). With more than 60 combined years of high-level Geographic Information System (GIS) expertise, and the Laboratory's most sophisticated GIS technology, GISLab possesses cutting-edge enterprise GIS capabilities for

data warehousing and delivery, three-dimensional modeling and visualization, and the ability to rapidly develop and support custom GIS applications. Research and development focuses on environmental applications of GIS and spatial decision support systems. GISLab offers a full suite of GIS services and consultation in support of Los Alamos projects and operations including cartography (hard copy and Internet), data service through Software Development Environment and Oracle, custom GIS applications, GPS mapping, spatial and numerical modeling, Internet GIS, and consultation on spatial information management and GIS technology. Over the years, GISLab has produced over 11,000 original maps and over 30,000 map copies for customers within and outside the Laboratory.

Los Alamos Seismic Hazards Program. Our Seismic Hazards Program evaluates possible seismic hazards to the Laboratory's nuclear facilities. These activities include paleoseismic and structural geology studies of the Los Alamos area, a felt-earthquake response team, and community outreach. Our Seismic Hazards Team also contributed to the Laboratory's recovery efforts from the Cerro Grande fire (which occurred in 2000) by studying the impact of topography on flooding and contaminant transport potential.

The EES-9 Group plans to form new multidisciplinary teams within the Laboratory based on geosciences, environmental engineering, toxicology, chemistry, quality and data assurance, environmental modeling, information management, probabilistic risk analysis, GIS, and the development of decision-making tools. Future research will address problems created by the increased pressure human populations are placing on the environment and natural resources, and the increased risks associated with naturally occurring hazards. EES-9 scientists will contribute to the development, nationally and internationally, of repository science. We also will expand upon our environmental remediation capabilities to the benefit of the DOE complex and others. ■

Geophysics—EES-11



ABOUT EES-11

Geophysical methods and tools are applied to societal issues ranging from oil exploration to earthquake hazards to national defense. At Los Alamos, our understanding of the Earth and the technical capabilities required for observing and conducting experiments enables us to address these challenges and provide solutions to our national needs.

For example, global oil exploration is now taking place in regions in which resources are difficult to locate and characterize because of the complexity of the geology overlying the resource. Because drilling in such regions becomes increasingly expensive, geologists need better methods to characterize Earth structures, as well as innovative, less invasive, and more cost-effective drilling methods. Our Geophysics Group has made a significant contribution by developing a technology for inexpensively drilling small boreholes. Also, by emplacing sensors in the drill holes, Los Alamos geophysicists can characterize the Earth through studies of modeling wave propagation. These tools also enable us to predict earthquake hazards in metropolitan areas, with the objective of mitigating the effects of an earthquake.

Another important area of seismic research is how explosions interact with geological structures. Not only is this knowledge vital to seismic exploration, it also applies to the identification of defense scenarios and nonproliferation agreements, because the willingness of a nation to restrict or eliminate nuclear testing is influenced by other nations' abilities to verify those agreements through seismic observations. Discrimination of earthquakes from chemical or nuclear explosions is a pressing need to government agencies tasked with verifying multinational agreements and treaties.

Our study of the dynamic nonlinear elasticity of earth materials is progressing rapidly at both microscopic and macroscopic levels. Our comprehensive theoretical and experimental framework, which is based on experimental and numerical approaches and observation, enables us to predict change in the static and dynamic stress states of materials.

Our research programs are in the following areas:

- Nuclear explosion monitoring
- Weapons effects
- Environmental restoration

- Dynamic nonlinear elasticity
- Petroleum exploration and reservoir characterization
- Advanced drilling concepts.

Five teams within the Geophysics Group address these areas:

The Nuclear Explosion Monitoring Team acquires, processes, and interprets geophysical and geological data for the DOE's Nuclear Explosion Monitoring Program. New methods and tools are being developed for reliably locating earthquakes and for discriminating natural earthquakes from man-made explosions.

We recently delivered a substantial amount of data, documentation, application tools, and correction surfaces to the DOE Knowledge Base that the Air Force Technical Applications Center applies in monitoring nuclear explosions. This effort, done in collaboration with Lawrence Livermore National Laboratory and Sandia National Laboratories, constituted the most comprehensive delivery to date for the Southeast Asia region.

The Geodynamics Team develops computational tools and experimental methods for application to national security issues that require modeling of the response of geological materials to large and rapid deformations. The team is currently studying a variety of nuclear and conventional weapons effects and is examining issues associated with coupling of explosions, including detecting, discriminating, and characterizing the underground environment. Our team undertook a sponsored project to apply computational tools in the development and fielding of improved seismic sources.

The Seismic Modeling and Imaging Team conducts basic and applied research in wave propagation, seismic imaging, scattering, and the interaction of acoustic waves with rock mass structure, fabric, and pore fluids. We are developing and testing a wide range of new methods for rapid modeling of seismic wave propagation and for obtaining improved seismic images of the Earth's subsurface.

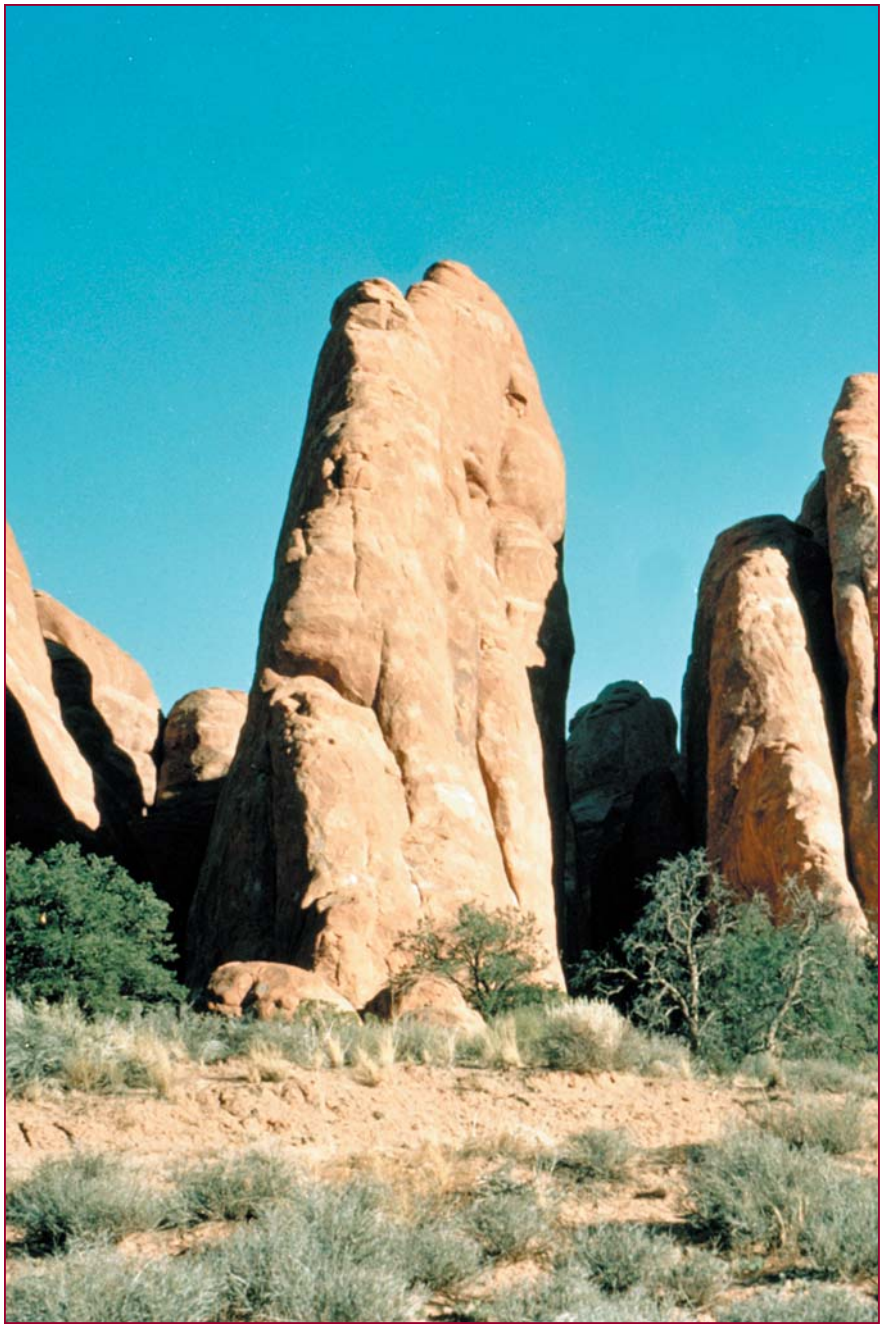
The Seismic Modeling and Imaging Team is currently involved in three projects. One project focuses on investigating improvements to standard approaches. The second focuses on generalized methods. The third focuses on evaluation of elastic and anisotropic wave propagation effects on seismic imaging, which is conventionally done with the assumption that the Earth transmits sound equally in all directions. In each project, we are developing new methods, implementing them on parallel computers, and investigating the range of applicability of the methods. All three projects are collaborative studies with the petroleum industry.

The team also observes and interprets seismicity caused by fluid injection, and energy reservoir production information. We have discovered, for example, that events often occur along structures that serve as flow paths.

The Drilling Team develops advanced drilling methods and tools and supports drilling operations for the Los Alamos Environmental Restoration Project. In collaboration with the US petroleum industry, the Laboratory is conducting an initiative to reduce the cost and impact of drilling by using microborehole technology. As part of the initiative, the team is adapting commercial coiled tubing technology to surface-based microhole drilling.

The National Defense Team's capabilities include geology, geophysics, expertise in the geologic phenomena associated with explosion dynamics both subsurface and aboveground, and intelligence gathering and interpretation using remote-sensing techniques. Los Alamos supports many Nuclear Explosion Monitoring Program requirements including geologic and intelligence activities and the development of a manual for conducting on-site inspection activities to ensure compliance. ■

Carlsbad Operations—EES-12



ABOUT EES-12

Los Alamos' Carlsbad Operations (CB) was established in April of 2000 and later that year became the senior technical advisor for transuranic waste (TRU) characterization. CB provides core scientific and engineering expertise to DOE's Carlsbad, NM, field office (CBFO). The CB office became the Laboratory's EES-12 Group in April 2002.

CB is comprised of scientists, engineers, technicians, and support staff operating out of a primary office in Carlsbad. CB maintains office space at CBFO and training and staging facilities in the Advanced Manufacturing and Training Center. DOE's Waste Isolation Pilot Plant (WIPP) received Environmental Protection Agency certification in May 1999. The first shipment of TRU departed Los Alamos for WIPP on March 25, 1999. It arrived at WIPP on March 26, 1999.

Vision

Our vision is to continue to operate the national TRU waste system safely and cost effectively, in compliance with applicable regulations and agreements and at full capacity in a fully integrated mode. CB will also continue to play a key role in supporting DOE's goal in removing barriers that impede waste disposition and in increasing the rate and cost efficiency of waste disposal at WIPP while maintaining safety.

Capabilities

CB has four major scientific capabilities in support of WIPP and the CBFO:

Actinide Chemistry. CB's core capability is conducting actinide chemistry to support repository performance at WIPP. Actinide chemistry, the area of knowledge concerning elements heavier than uranium, is important to WIPP. A new collaboration with New Mexico State University's Carlsbad Environmental Monitoring & Research Center (CEMRC) seeks to better understand the behavior of these elements. This research program also includes repository science investigations to better use WIPP, reduce costs, and ensure safe and economical use far into the future. CB's new research program at the WIPP site will apply advanced laboratory capabilities to

studies of the chemistry of materials. These studies are important for geologic repositories and to strengthening the field of repository science. CB is also studying plutonium behavior in the WIPP environment with laser photoacoustic spectrometry and other state-of-the-art equipment.

To accommodate these needs, a mobile contaminant analysis automation (CAA) laboratory has been located at CEMRC. DOE's Environmental Management Office of Science and Technology (EM-50) developed the CAA Laboratory with Los Alamos as a mobile laboratory that can be quickly sent to a site in need of specific chemical or contaminant characterization and analysis.

Waste Characterization. CB is WIPP's senior technical advisor for waste characterization. Waste characterization involves collecting and checking information on defense-generated transuranic waste to ensure that the waste contains only materials that are approved and that meet the requirements for disposal at WIPP.

In collaboration with various Laboratory chemistry organizations, CB develops and implements innovative approaches for nondestructive assay and evaluation, headspace gas analysis, and "acceptable knowledge." Acceptable knowledge includes a number of techniques used to characterize TRU mixed waste such as process knowledge, records of analysis acquired before the Resource Conservation and Recovery Act (RCRA, EPA 1994), and other supplemental sampling and analysis data. As an alternative to sampling and analysis, acceptable knowledge can be used to meet all or part of the waste characterization requirements under RCRA. The current waste certification process is a quality assurance and audit-based process to ensure that each generator and storage site implements requirements and maintains compliance. This process is complex and both time- and money-intensive. Experience at the large-quantity sites (LQS) such as Los Alamos since 1999 has demonstrated that implementing a cost-effective waste confirmation audit process at each of the 17 small-quantity sites (SQS) would not be practical. In cooperation with CB, DOE is devising a plan to provide the SQS with characterization and certification capability. DOE's National TRU Program also aims to centralize the waste confirmation process at a central confirmation facility (CCF) at WIPP. Achieving a performance-driven confirmation system through implementation of the CCF is a principal component of the optimized national TRU waste system.

As DOE's CBFO technical lead for the newly reorganized TRU and mixed waste focus area, CB is responsible for identifying complexwide TRU waste technology needs and proposing solutions through the EM-50 system.

Waste Optimization. CB leads CBFO efforts to implement innovative concepts and technologies to increase efficiencies throughout the DOE complex. With the WIPP repository open, efforts now focus on achieving the following strategic visions of DOE's WIPP and National Transuranic Waste Program:

- Removal of all TRU waste from DOE closure sites.
- Disposal of all legacy TRU waste from DOE sites with an ongoing nuclear mission.
- Disposal of all TRU waste as it is generated.

In addition, CB leads CBFO planning efforts to accelerate the disposition of TRU waste by 20 years, for a DOE-projected savings of $8 billion.

TRUPACT II Mobile Loading Unit. The TRUPACT II mobile loading unit, managed by CB, received DOE National Transportation authorization in November 2001. It is ready for deployment to DOE TRU waste generator and storage sites throughout the United States. CB was the lead for DOE's successful National Transportation Authorization Audit, a critical milestone for WIPP and optimization efforts.

The mobile loading unit, which is transported by truck, contains a suite of equipment capable of safely loading authorized containers of defense-generated TRU waste into the TRUPACT II containers that DOE uses to ship defense-generated transuranic waste to WIPP.

Recent Accomplishments

CB has four major areas of accomplishment that support WIPP and CBFO. It

- Provides technical and programmatic support to the CBFO.
- Develops plans and processes to improve efficiencies related to TRU waste management and disposal.
- Addresses scientific issues in actinide chemistry and repository science as they arise—particularly if they impact certification and performance.
- Serves as the acceptable knowledge expert focused on certifying TRU waste from DOE complex SQS and other LQS. ■

Institute of Geophysics and Planetary Physics—IGPP

ABOUT IGPP

The Institute of Geophysics and Planetary Physics (IGPP) at Los Alamos is a branch of the University of California's system of institutes for the study of geophysics and planetary physics. A major strategy in IGPP's systemwide approach to strengthening its competencies is the development of collaborations between laboratory and university researchers. Los Alamos National Laboratory supports basic research in geosciences, space sciences, astrophysics, and complex dynamical systems with emphasis on the Earth's environment and climate.

Details of IGPP's four main focus areas follow:

Astrophysics. Our astrophysics focus fosters theoretical, observational, and instrumentation research. Of particular interest are multidisciplinary projects at the boundaries between astrophysics and nuclear physics, particle physics, condensed matter physics, plasma physics, and general relativity. Recent research supported under this focus includes projects in gamma-ray astrophysics, space instrumentation, stellar dynamics, neutron star physics, cosmic rays, solar neutrinos, primordial black holes, intergalactic magnetic fields, active galactic nuclei, and the cosmic microwave background. Besides these topics, we are interested in supporting research on supernovae, the energetics of supermassive black holes, physics of accretion disks, dynamics of radio pulsars, and the dynamics of interactions between superfluids and normal matter.

Space Physics. Our space physics focus supports theoretical, computational, and observational research into the plasma environment of Earth, the processes that affect this environment, and the transport of plasma and energy from the sun through interplanetary space to Earth. These areas include the interaction of various plasma populations and the coupling of microscopic and macroscopic phenomena. Particular emphasis is placed on advancing our understanding of processes and conditions on the sun and in the solar wind, magnetosphere, ionosphere, and thermosphere that can influence space weather and the performance and reliability of spaceborne and ground-based technological systems. In addition, IGPP research is directed at furthering our understanding of

Photo courtesy of National Aeronautics and Space Administration

magnetospheric substorms, magnetotail current sheet dynamics, and dusty plasmas.

Solid Planetary Geosciences. IGPP's solid planetary geoscience focus supports a breadth of basic research extending from the lithosphere to planetary interiors, including numerical, seismic, paleomagnetic, and laboratory studies of the geophysical and geochemical structure, properties, processes, and fluid dynamics of terrestrial and giant planets. Major emphasis is on mantle and core dynamics, numerical convective models, seismic and electrical tomography, thermal fields, magnetic field generation, and variations seen in geodynamo models and magnetic observations. In addition, IGPP encourages studies of magma chamber processes, fluid flow in porous and fractured media, elasticity of material under high pressure, and rock-water interactions and their monitoring with suitable tracers.

Complex Dynamical Systems. Our complex dynamical systems focus emphasizes the nonlinear dynamics and multiequilibria of the coupled atmosphere, liquid and ice-covered oceans, hydrosphere, and biosphere of planet Earth. Of special interest are studies that extend our understanding of

- Causes of temporal variations of ocean basin-scale oscillations and the rapid climate change created by abrupt changes in oceanic circulation or atmospheric dynamics.
- The influence of variable solar forcing.
- Interactions between regional and global ecohydrology, including soil-bacteria-plant-atmosphere interactions, on daily through decade-long time scales. ■