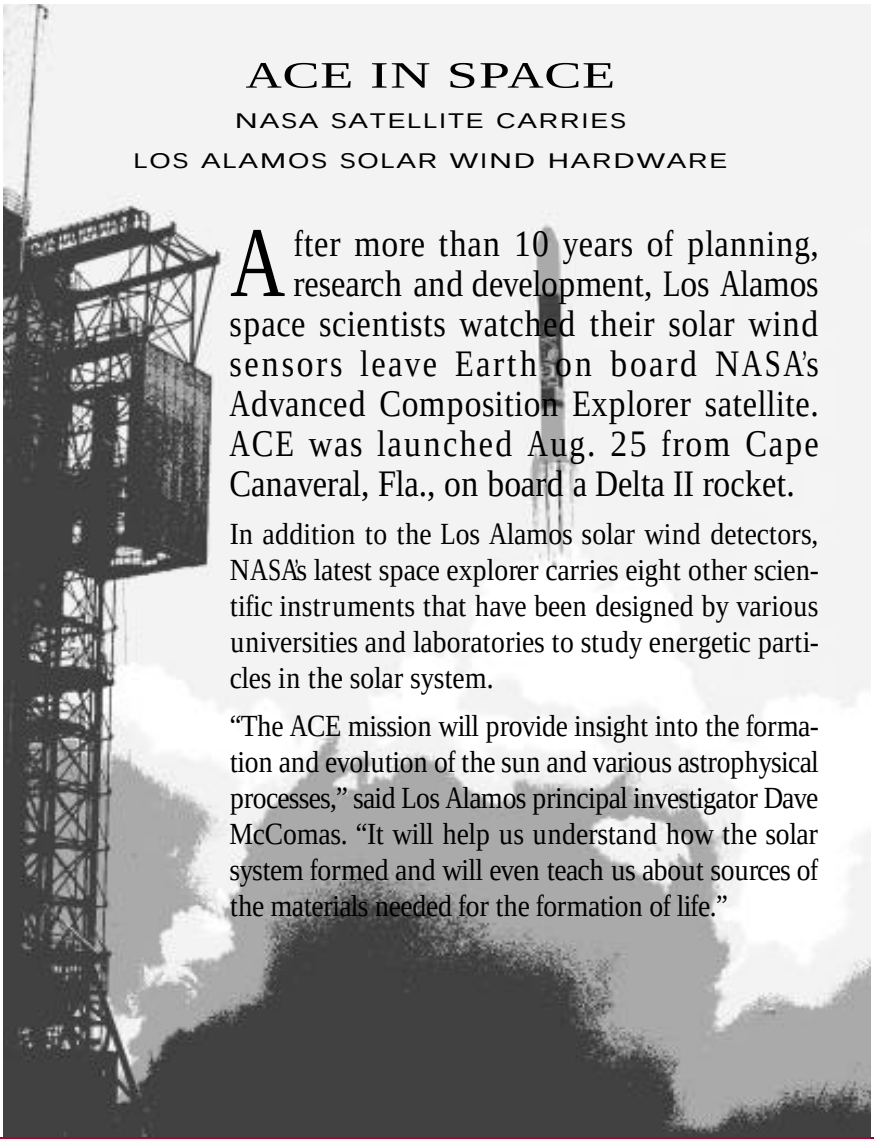
LOS ALAMOS NATIONAL LABORATORY
WHERE SCIENCE MAKES A DIFFERENCE

DATELINE
LOS ALAMOS

ACE IN SPACE

NASA SATELLITE CARRIES LOS ALAMOS SOLAR WIND HARDWARE



After more than 10 years of planning, research and development, Los Alamos space scientists watched their solar wind sensors leave Earth on board NASA's Advanced Composition Explorer satellite. ACE was launched Aug. 25 from Cape Canaveral, Fla., on board a Delta II rocket.

In addition to the Los Alamos solar wind detectors, NASA's latest space explorer carries eight other scientific instruments that have been designed by various universities and laboratories to study energetic particles in the solar system.

"The ACE mission will provide insight into the formation and evolution of the sun and various astrophysical processes," said Los Alamos principal investigator Dave McComas. "It will help us understand how the solar system formed and will even teach us about sources of the materials needed for the formation of life."

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ON THE COVER

A Boeing Delta II rocket lifts off from Cape Canaveral on Aug. 25 with NASA's Advanced Composition Explorer satellite — ACE. On board the satellite are solar wind detectors designed by Los Alamos scientists.

NASA photo

Earth is bombarded constantly with high-speed particles coming from the sun and sources outside the solar system. ACE, orbiting at one-hundredth the distance from Earth to the sun, will provide scientists with information about these particles and identify which ones are likely to hit the planet. ACE also will be able to warn scientists of potential geomagnetic storms caused by coronal mass ejections that can destroy satellites and disrupt electronic communications and electrical power grids.

Los Alamos' Solar Wind Electron Proton Alpha Monitor — SWEPAM — provides the solar wind observations for the ACE mission. These observations provide the context for elemental and isotopic composition measurements for the other experiments on ACE. The data also will provide researchers an opportunity to study solar wind phenomena such as coronal mass ejections, interplanetary shocks and solar wind structure.

The solar wind is part of the sun's corona that cannot be held down by the sun's gravity. Instead, the outer fringes of the coronal plasma flow away in all directions in a constant stream of particles moving at roughly a million

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miles an hour. The sun's magnetic field controls how fast the wind moves into outer space.

Near the sun's equator, the magnetic field lets relatively slow-moving particles escape, while at the higher latitudes only the fast-moving ones are released. When the fast-moving particles overtake the slower ones, they produce a shock wave similar to a jet's sonic boom on Earth.

Coronal mass ejections can contribute to these interplanetary shocks by expelling a bubble of gas with a strong magnetic field that may contain billions of tons of matter that travel outward at several million miles per hour. The solar material streaks out among the planets and impacts anything in its path, sometimes disrupting satellites, radar and radio signals.

The scientists at Los Alamos will measure the solar wind using two instruments that measure in three dimensions the density, energies and directions of travel for electrons and ions. Each device consumes only 5 watts of power and together the instruments weigh only 15 pounds. The solar wind ion and electron detectors collect the particles through apertures directing them into a pathway between a pair of parallel electrically charged metal plates. By adjusting the plates' voltages, scientists can tune their instruments to collect particles of different energies.

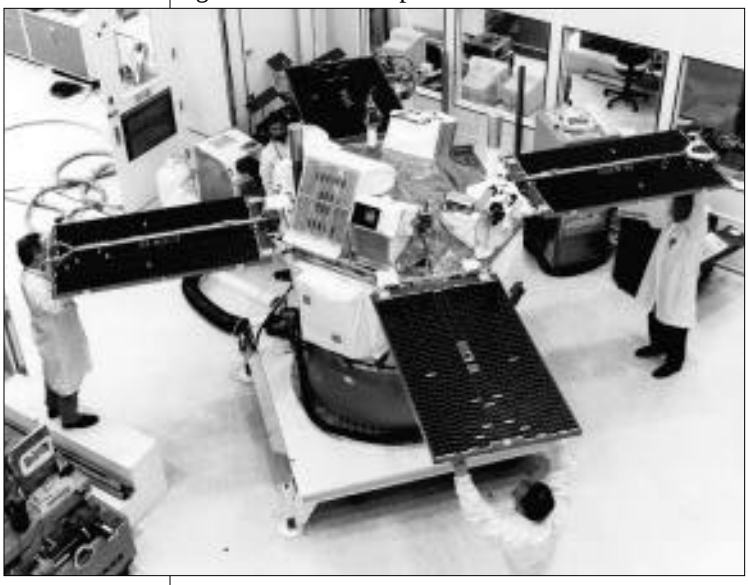
Los Alamos project manager Phil Barker (left) and principal investigator Dave McComas with a model of the ACE satellite.

As the satellite spins, the detectors sweep across conical segments of the sky centered on the spacecraft's spin direction. The combination of a particle detection and the spin of the spacecraft provides unique directional information for each particle measured.

The detection units were recycled, refurbished and enhanced from versions of the solar wind instruments from the Ulysses project. Launched by the space shuttle Discovery in October 1990, Ulysses flew by Jupiter in February 1992. The primary goals of Ulysses were to investigate the properties of the solar wind and the heliospheric magnetic field out of the plane of the planets where all previous spacecraft had been located.

In contrast, ACE will stay in this plane but will observe the composition of particles in space with 10 to 1,000 times better sensitivity than was previously possible.

The spacecraft will travel for 116 days after launch to a distance of a million miles from Earth, where it will attain a halo orbit about the gravitational null point between the sun and Earth. ACE is expected to spend 2 to 5 years in this orbit. About 30 days after launch, the Los Alamos equipment will be activated. Data will be analyzed not only by Los Alamos and NASA scientists, but by a team of New Mexico junior high and high school students as part of the Laboratory's Data Analysis Team and Outreach Program.



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ACE's solar panels are deployed at the Applied Physics Laboratory of Johns Hopkins University.

JHU/APL photo

SWEPAM was built by Los Alamos and Sandia national laboratories. The ACE mission is a joint effort of NASA, Goddard Space Flight Center, the California Institute of Technology and Johns Hopkins University Applied Physics Laboratory. Other contributing scientific institutions include Washington University; the University of Bern, Switzerland; the University of Maryland; the Max Planck Institute for Extraterrestrial Physics, Germany; the University of New Hampshire; the University of Delaware; the University of Chicago; and the Jet Propulsion Laboratory.

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LOS ALAMOS ACE/SWEPAM WEB SITE ADDRESS:
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DATELINE: LOS ALAMOS

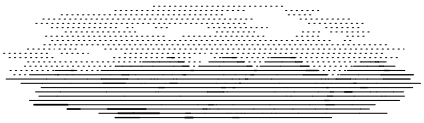
STUDENTS INVENTORY WILDLANDS

DATA USED TO ESTIMATE THE RISK OF SEVERE FIRES AT LABORATORY

Three undergraduate forestry students from Stephen F. Austin State University in Nacogdoches, Texas, spent the summer inventorying forests and woodlands at the Laboratory to gather data that will help monitor the potential for severe fires to occur.

Joshua Phillips, Dana Beck and Kelly Scott, working with project leader Randy Balice, sampled the amount of underbrush such as shrubs, herbs and grasses; living trees; and dead, downed wood in 200-foot circles at more than 40 selected spots around the Laboratory.

Kelly Scott (left) and Joshua Phillips inventory the herbaceous and woody fuels on the ground at a Laboratory technical site.



The data they gathered are being entered into a computer to develop estimates of tons-per-acre of fuel on Laboratory lands. The data also can compare the amount of fuel at different areas around the Laboratory.

The need for such an inventory was brought into focus by last year's Dome Fire, which burned nearly 17,000 acres of forest land near the Laboratory. The Interagency Fire Management Team, made up of representatives from the Laboratory, the Los Alamos County Fire Department, Bandelier National Monument and the U.S. Forest Service, recommended there be an assessment to determine how much fuel is present on Laboratory wildlands and how much of a fire risk this fuel represents.

"Fuels are anything that will burn; if you have a lot of fuels, you have a likelihood of severe fires," said Balice, noting that last year's Dome Fire grew so large in part because of thick forest growth and heavy fuels. In particular, western portions of the Lab have large accumulations of fuels that could contribute to a catastrophic fire, according to Balice.

The information gathered this summer will help the Laboratory and the interagency fire-management team decide where trees need to be thinned or where controlled burns would help reduce the fire hazard.

Funding for the students' research came from Los Alamos, Stephen F. Austin State University and the U.S. Forest Service.

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DATELINE: LOS ALAMOS

MrSID KNOWS THE INTERNET

SOFTWARE ALLOWS USERS TO STORE AND RETRIEVE DATA WITH MORE EFFICIENCY AND GREATER ACCESS SPEED THAN COMPETITORS

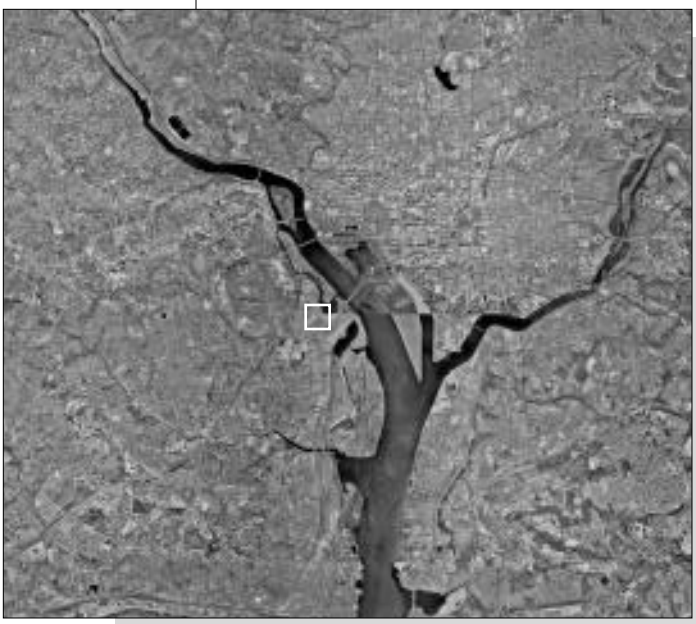
The Internet is a huge warehouse of information. Despite its storage capabilities, the Internet has not been capable of publishing large digital files like detailed maps or high-resolution artwork — until now. A new software developed at Los Alamos, Multiresolution Seamless Image Database, or MrSID, makes retrieving and storing computer data faster and easier than ever.

MrSID allows fast transmission and viewing of massive images in a seamless manner and at multiple resolutions. It is based on the discrete wavelet transform (DWT) image-compression technology, which is the highest quality image compressor available in the computer industry. It is a set of cross-platform software applications that compress large images and image databases.

For the first time ever, a computer user can decompress only a specific portion of interest from the larger compressed image. If only one-tenth of 1 percent of a massive digital image can be viewed on a workstation, users find it difficult to form a mental picture of the data set, let alone spot a feature of interest. Viewing the image at less than full resolution allows visualizing larger regions in the image. DWT facilitates the extraction of data at arbitrary locations in a seamless manner. Using DWT, researchers can put together many separate digital images to form a continuous image with no visible seams.

Three novel developments are incorporated in MrSID. One is a memory-efficient DWT implementation — essential for the extremely large dimensions of satellite images. The second is an adaptation of the DWT's inherent multiscale image representation to provide a multiresolution stand-alone browsing capability. And the third is the capability to decompress a specific portion of the large compressed image.

Although MrSID competes with numerous other software packages, the most important benefits Los Alamos brings to the market are seamless, multiresolution viewing of large images, memory-efficient storage and



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Orthophotos of the Pentagon and its surroundings. The image above left has a resolution of 16 meters per pixel. This means that each pixel, or dot, in the image is 16 meters away from the nearest pixel. The image below left is at a resolution of 1 meter per pixel. It shows the area inside the white box in the image at left. An orthophoto is an image derived from aerial photographs that has been digitized and rectified to result in an 8-bit gray-scale image free of displacements caused by camera tilt and terrain relief. These images require a large storage capacity, for example 1.4 gigabytes, but MrSID allows them to be compressed to 100 megabytes and retrieved in approximately 2 seconds on a Power PC 601.

transmittal of information, the capability to decompress a specific portion of the larger compressed representation and a wide public access to geographic information via the Internet.

Now that geographic maps are accessible online, to examine an 1882 map of Santa Fe, for instance, no longer requires a trip to the Library of Congress in Washington, D.C. where this and millions of other geographic maps are located. With the development of MrSID, the Library of Congress has put 26 maps online and expects to put online another 4.5 million.

➔ More orthophotos of the Pentagon and its surroundings. These are (from top to bottom) at resolutions of 2, 4 and 8 meters per pixel.

MrSID was originally developed for use in geographic information systems but has the potential to be used as an efficient method for storing and retrieving photographic archives. It can store and retrieve satellite data for consumer games and educational CD-ROMs and it is well suited for use in vehicle navigation systems. It also holds promise in the use of image compression and editing for desktop publishing and nonlinear digital video software.

Geographic information systems are typically used by law enforcement and other government agencies to ensure prompt response to emergency calls. Utility companies use these systems to improve maintenance of services. Environmentalists and urban planners use these systems to plan new roads, for example, and primary and secondary educators use these systems to instruct children in ecology and geography.

LizardTech of Seattle, Wash., obtained the license to commercialize MrSID. Several potential commercial and industrial users of MrSID are working with LizardTech to determine an appropriate strategy for third-party licensing.

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DATELINE: LOS ALAMOS

IN THE NEWS . . .

HECKER RECEIVES DOE AWARD

Los Alamos Director Sig Hecker was given the Department of Energy's Distinguished Associate Award, the highest honor the DOE can bestow, at a special symposium Aug. 7 in Los Alamos. The symposium, which drew guests and presenters from around the world, celebrated Hecker's career and his nearly 12-year tenure as Laboratory director. Hecker will step down as director later this fall. He will continue working at Los Alamos, but plans to resume his earlier scientific research on plutonium metallurgy. In addition to returning to science, Hecker will become an adviser to the University of California president. Plus, he will actively continue his work developing and strengthening collaborations with the Russian nuclear laboratories. Maurice Katz, DOE's director of Lab Management Division, presented the award on behalf of Energy Secretary Federico Peña, who nominated Hecker for the award.

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Director Sig Hecker (right) receives the DOE's Distinguished Associate Award from Maurice Katz.

PRIZE-WINNING PAPER ESTIMATES SAVINGS OF $330 MILLION

Stan Kosiewicz, a researcher in the Laboratory's Environmental Science and Waste Technology Group, was honored for giving the best presentation of a scientific paper at a recent conference on environmental management. He won first place in the Best Oral Paper Competition at WM '97, a national waste management conference held in Tucson, Ariz. Kosiewicz's paper, "Los Alamos National Laboratory Accelerated Transuranic Waste Workoff Strategies," described potential strategies for preparing Los Alamos transuranic waste for

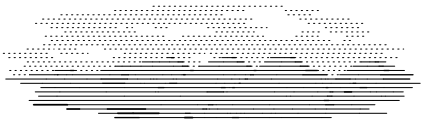
Stan Kosiewicz

shipment to the Waste Isolation Pilot Plant, a proposed repository for transuranic waste located near Carlsbad, N.M. Implementing strategies outlined in the award-winning paper could save taxpayers an estimated $330 million. The Laboratory strategies could be the first example of the savings available from recommendations in the report, "Accelerating Cleanup: Focus on 2006." The paper was co-authored by Los Alamos researchers Ines Triay, Pamela Rogers and Davis Christensen. Nearly 250 papers were presented orally at the conference. Organizers evaluated the oral presentation and the written, technical paper as part of the competition. Evaluation criteria included presentation skills, originality, significance of the work, development of technical logic and relationship to previously published work.

FORMER LOS ALAMOS DIRECTOR DIES

Norris Bradbury, who succeeded J. Robert Oppenheimer as director of Los Alamos, died Aug. 21 at the age of 88. When offered the position of director of the Laboratory in 1945, Bradbury reluctantly agreed to take the job for six months or until it was filled permanently, whichever came first. He remained director for 25 years, overseeing the transition of the Laboratory from the site of a wartime crash project to one of the nation's premier research facilities. Bradbury joined Los Alamos in July 1944 to work on the Manhattan Project, where he was in charge of assembling the non-nuclear components for the world's first nuclear explosion, which occurred at Trinity Site in southern New Mexico on July 16, 1945. Bradbury earned a doctorate in physics from the University of California, Berkeley, for work in the mobility of ions in gases. During the 1930s he established a reputation as an expert on the conduction of electricity in gases, properties of ions and atmospheric electricity. The Atomic Energy Commission presented Bradbury with its highest honor, the Enrico Fermi Award, in 1970. He also received the Legion of Merit from the Navy, the 1964 annual achievement award from the New Mexico Academy of Science and the Distinguished Public Service Medal from the Department of Defense in 1966.


Norris Bradbury



BRIEFLY ...

CONGRESSMAN BILL REDMOND (R-N.M.) ANNOUNCED THAT HE WILL SUPPORT THE FOUR-YEAR ENVIRONMENTAL SCIENCE UNDERGRADUATE PROGRAM recently instituted by the Laboratory and Los Alamos researcher Anthony Gallegos at Northern New Mexico Community College in Española. Redmond will act as a facilitator for the college and scout for available funding sources. The program will allow students to complete their first three years of environmental science courses at Northern with the option to complete their final year and bachelor's degree at either New Mexico Highlands University in Las Vegas or New Mexico State University in Las Cruces. Some concerns regarding Los Alamos funding initially left college officials uncertain about the future of the program, but Rick Ulibarri of Los Alamos' Government Relations Office assures that support will continue. Because northern New Mexico is on the cutting edge of science and technology, Redmond would like the region to maintain its position as well as produce more home-grown northern New Mexico scientists.

IN THIS ISSUE:

Dateline: Los Alamos is available on the World Wide Web: http://lib-www.lanl.gov/pubs/dateline.htm

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