Reflections

Los Alamos National Laboratory

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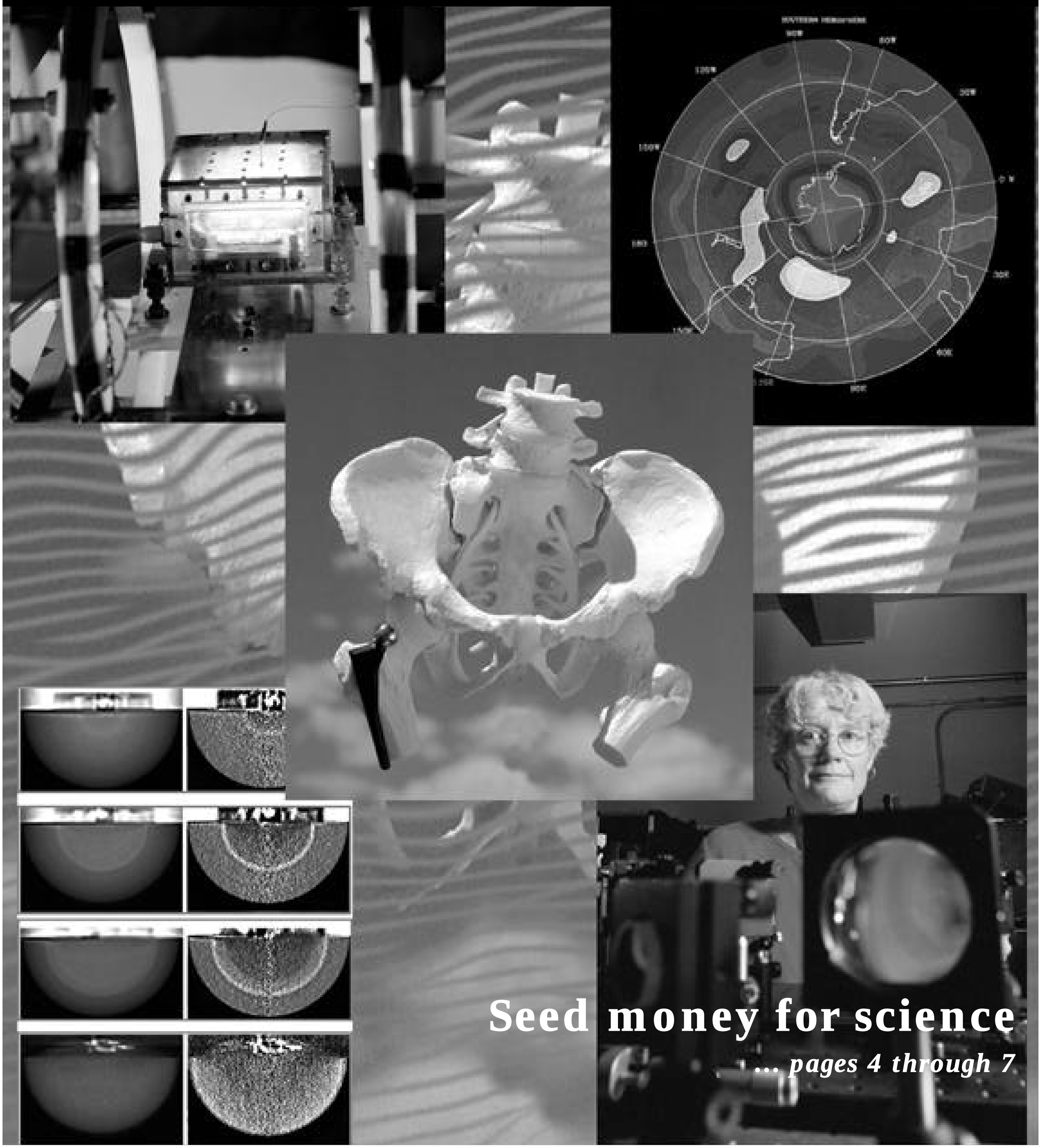

Seed money for science

... pages 4 through 7

A Department of Energy/University of California Laboratory

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Cover illustration by Ed Vigil

Reflections

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editor's journal

From little acorns...

Mighty oaks from little acorns grow. I can't remember exactly where or in what context I first heard this phrase, but I'm sure I didn't give it much thought. I certainly didn't think about acorns being the source of towering trees when I was a kid running around our backyard flicking them at my brothers. But as I've come to better appreciate the world around me, tiny seeds giving rise to towering trees is one of those things in nature that I marvel at. Which brings me to the feature article in this month's "Reflections." It's on the Lab's Laboratory-Directed Research and Development (LDRD) Program, which some appropriately refer to as "seed money" for science.

Like the tiny seeds that grow into giant trees, the basic research funded by LDRD programs has led to the development of some important and creative innovations — science and technology that have helped the Laboratory advance its missions and enhance its reputation for scientific excellence. The LDRD program, which is part of the Science and Technology Base (STB) Program Office, focuses resources on the early exploration of creative ideas that address the Lab's core national security mission and support new initiatives. It has a budget of about $70 million a year and supports more than 200 projects at the Lab in a variety of disciplines.

LDRD-funded research in five major areas is highlighted in this issue: weapons and stockpile, accelerator technologies, threat reduction, bioscience and environmental sciences (see Page 4). The material was reprinted from the August issue of "Dateline: Los Alamos," which highlights the LDRD program. A monthly publication, "Dateline: Los Alamos" makes available information about Lab advances in science and technology to agencies and organizations that fund Lab programs. ("Dateline: Los Alamos" is available online at http://www.lanl.gov/worldview/news/dateline/.)

A noteworthy tidbit about LDRD is that its projects account for 60 percent of the R&D 100 awards won by the Laboratory. These prestigious awards are presented each year by R&D Magazine to the nation's top 100 technological achievements. This year the Laboratory won seven R&D 100 awards, giving the Laboratory a total of 63 awards won over the past 12 years — the Laboratory has won more awards than any other institution during the same period. The Lab's most recent award-winning innovations will be featured in next month's "Reflections."

Want to know more about the LDRD program? There's a wealth of information available online at http://ldrd-web.lanl.gov:8090/.

Technology from 'The Hill' Demonstrated on 'The Hill'

Projects and technologies from the Laboratory and other parts of the Department of Energy complex found the spotlight in May during the "Technology to Counter Emerging Threats" demonstration on Capitol Hill in Washington, D.C.

Sponsored by DOE's Office of Nonproliferation and National Security, the event showed Congress, staff, partner agencies and the public the kinds of research under way to combat chemical, biological and nuclear weapons of mass destruction.

The Laboratory demonstrated radiation detectors, a tiny satellite navigational robot, the airborne toxin release/ TRANSIMS computer model, the Advanced Multisensor Integrated Security System, plasma jet decontamination, the active interrogation package monitor and the modeling of the electric energy grid.

Don Cobb, associate Laboratory director for threat reduction (ALDTR); John Immele of ALDTR; Dave Simons of Nonproliferation and Arms Control Research and Development (NIS-RD); Chad Olinger of Safeguards Systems (NIS-7); and Don Close of Advanced Nuclear Technology (NIS-6) served as hosts.

Rob York of NIS-6, Stephen Knox of Space and Atmospheric Sciences (NIS-1) and Michael Brown of Energy and Environmental Analysis (TSA-4) brought samples of equipment or software. LeRoy N. Sanchez of Public Affairs (PA) was the official photographer for the event.

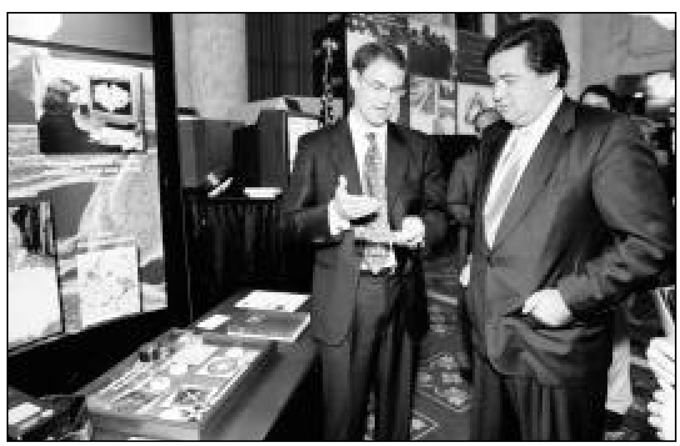
A web page on the event, where fact sheets, copies of the posters and pictures are posted, is located at http://www.hilldemo.lanl.gov.

Text by Nancy Ambrosiano
Photos by LeRoy N. Sanchez

Sen. Pete Domenici, R-N.M., welcomes participants and guests to the U.S. Senate room where the event was held while reporters note his comments and prepare questions.

Stephen Knox, left, of NIS-1 gives Associate Laboratory Director for Threat Reduction Don Cobb, center, and Dennis Reynolds of Sandia National Laboratories a preview of the light-detecting robot satellite device, moving a flashlight beam over its sensors to make it swing around and face the light.

Stephen Knox of Space and Atmospheric Sciences (NIS-1) demonstrates a tiny satellite robot model to visiting Española student Alisha Salazar, right, while her mother, Donna Salazar, looks on. Alisha Salazar's sixth-grade class from Fairview Elementary stopped by the site during a tour of Capitol Hill as part of a spring trip.



Secretary of Energy Bill Richardson, right, looks over the "Responses to Chemical and Biological Terrorism" poster and displays as Page Stoutland of Nonproliferation and Arms Control Research and Development (NIS-RD), currently assigned to DOE Headquarters, describes the varied research thrusts.

Seed money for science

Editor's note: The Laboratory-Directed Research and Development (LDRD) Program and its predecessors have been vital components of the Laboratory's scientific environment since the Lab was established 56 years ago. The program focuses resources on the early exploration of creative ideas that address the Lab's core national security mission and support new initiatives. The August issue of "Dateline: Los Alamos" highlights the LDRD Program and the innovative science it has produced. "Reflections" is providing a small sample of the information in the special "Dateline" issue.

For physicist Toni Taylor, a program providing "seed money" for innovative research at the Laboratory is invaluable — to researchers, the Laboratory and the nation.

Taylor has worked on several projects funded by just such a program, Laboratory-Directed Research and Development (LDRD), including a project funded several years ago to develop a special laser system.

The project was designed to perform fundamental scientific research, but the laser system eventually became an important component of a subcritical experiment conducted at the Nevada Test Site last year to obtain information about the safety and reliability of U.S. nuclear weapons without underground testing.

Toni Taylor of Condensed Matter and Thermal Physics (MST-10) in her lab. *Photo by LeRoy N. Sanchez*

"The basic science that LDRD funds often has valuable applications that you don't foresee, that can't be foreseen," Taylor said. "LDRD has provided crucial funding to me and other researchers. It contributes to the technical base of Los Alamos. Without it, we'd just be another laboratory without the reputation that we have now."

The funding limit for the LDRD Program at the Laboratory, and similar programs at Lawrence Livermore and Sandia national laboratories, is 6 percent of the total operating and capital equipment budget. For the Lab, the figure is about $70 million a year, which is used to support more than 200 projects.

Although the program receives only 6 percent or less of the annual budget, in the past 10 years LDRD projects have accounted for about 30 percent of the Laboratory's publications, 40 percent of its patents and 60 percent of its R&D 100 awards (presented by "R&D Magazine" to the nation's top 100 technological achievements each year).

"The lifeblood of scientific research institutions is the ability to tap the creativity of individual scientists," said Bill Press, deputy director for science, technology and programs, whose office oversees the LDRD program. "At Los Alamos, LDRD provides an essential mechanism for scientists and engineers to offer their best ideas to advance the science and technology underpinning our missions."

The following brief summaries highlight LDRD-funded research in five major areas: weapons and the stockpile, accelerator technologies, threat reduction, biosciences and environmental sciences.

Weapons and the Stockpile

The graying of polymers

Those tires on your car or other parts that make up today's lighter vehicles. The soles of your shoes. Certain adhesives, or that plastic wrap you used to lock in the freshness of last night's dinner.

What do they all have in common? They're made in part out of polymeric materials.

"They're just all over the place and used many different ways," said Ed Kober of Detonation Theory and Application (T-14), principal investigator of a Laboratory team studying polymer materials and the effects of their aging.

When car tires or shoe soles wear out, they're replaced or repaired, while the plastic wrap usually gets tossed. It's a little different with nuclear weapons.

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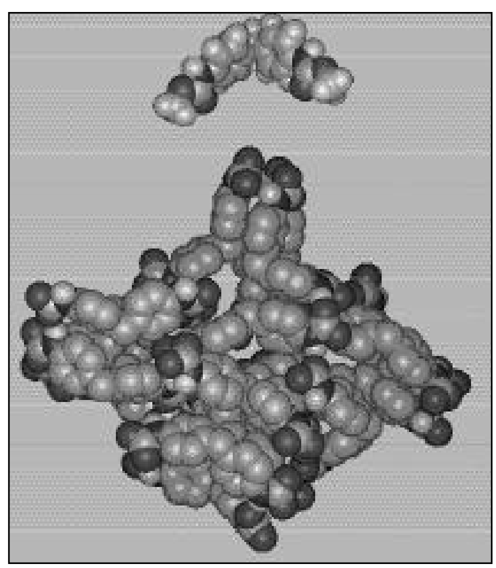

This illustration shows atomic level views of segments of a polymer being studied at the Lab by researchers examining the aging of polymers. *Illustration by Thomas Sewell of T-14*

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The thrust of the polymeric materials aging project is to identify and characterize aging mechanisms in polymeric materials in Lab-designed weapons and predict material properties in a weapon environment over an extended lifetime.

"We're trying to understand these materials across the tremendous length scale ranging from angstroms (one ten-billionth of a meter) to centimeters and, over time, scales of microseconds to years," said Kober.

In the weapons arena, polymer-based materials are used as a binder in some high-explosive compositions, said Kober. "It's the glue that holds them all together," he said, also noting that because of the polymer material's elasticity characteristics, it can be molded into various shapes.

The researchers hope to determine how aging drivers, such as time and water, affect the polymer material used in weapons. Water is a driver, Kober explained, because it is used in the casting machining processes.

Nuggets of data

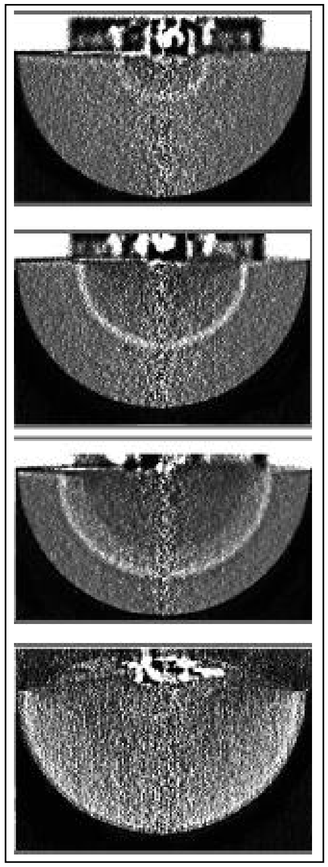
Finding useful information and significant connections in large quantities of data is a challenge for nuclear weaponeers and financial analysts alike. The process of "data mining," or extracting essential information from large data sets, has grown increasingly important as science and society churn out greater collections of data.

Lab researchers, led by Kenneth Lee of Safeguards Systems (NIS-7), have developed a software tool that makes it easier for data miners to tackle large collections of unstructured data.

The software, called PADMA for PArallel Data Mining Agents, could be used to extract information from archived nuclear weapons data. Such data exist at various Department of Energy sites and in scattered locations at each site, and current Science-Based Stockpile Stewardship experiments will add to the database.

PADMA also has broad applications in the financial and medical fields. For example, its ability to discover patterns in data has been demonstrated on laboratory test data from a Hepatitis C study and on autopsy reports.

Accelerator Technologies



These radiographs of a high-explosives experiment at the Lab show reconstructed density images at different stages of an explosion.

Say 'cheese'

The art of taking pictures has come a long way from the days of box cameras that grandma and grandpa used to capture images that would last a lifetime. Digital cameras have replaced analog cameras for taking still photographs, eliminating the need for negatives, film paper and messy chemicals.

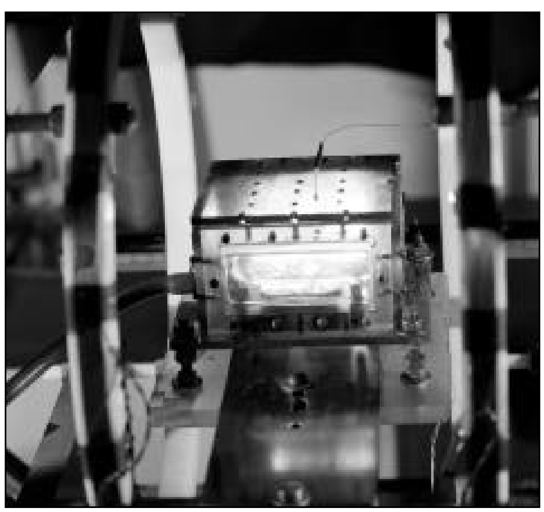
Researchers are using the 800-million-electron-volt proton beam at the Los Alamos Neutron Science Center (LANSCE) as an even more advanced "camera" to capture images of a detonation wave from a small-scale explosion. They use the technique of proton radiography, the newest tool aiding the Laboratory in its mission of Science-Based Stockpile Stewardship.

"In the era of the Comprehensive Test Ban Treaty, which heralds an end to nuclear tests, we have a real need for new radiographic tools, especially those that can be used for dynamic experiments, if we are to understand how weapons components age over time," said Chris Morris of Subatomic Physics (P-25), chief scientist for the Lab's proton radiography project.

"The success of research in Los Alamos has led to the recent decision to use protons in a future facility for hydrodynamic testing of nuclear weapons mockups," he said.

In 1997, Los Alamos scientists demonstrated the possibilities of proton radiography in the stockpile stewardship realm when they photographed the detonation wave from a small-scale explosion.

Conventional radiography is most often done with X-rays or neutrons. But in the recent experiment, researchers used protons — which have several potential advantages over X-rays — to take a picture of what happened shortly after detonation.



Intense laser light polarizes helium-3 gas contained in this device, sometimes called a "spin filter." Neutrons passed through the gas produce a polarized neutron beam. *Photo by LeRoy N. Sanchez*

Putting the right spin on it

The Superconducting Supercollider is history, and accelerator time at CERN, the European Center for Particle Physics, is limited. However, Laboratory scientists using new technology are doing big science without the high energies offered by those big accelerators.

The Los Alamos Neutron Science Center (LANSCE) is the most powerful pulsed neutron spallation source in the United States, and Seppo Penttila of Neutron Science and Technology (P-23)

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and his collaborators are taking full advantage of its capabilities.

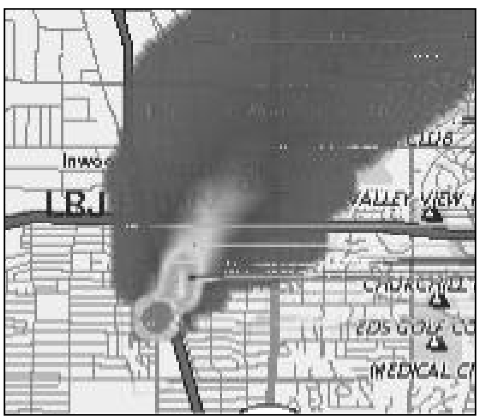
Penttila has developed an instrument that uses a dense volume of helium-3 gas to polarize, or line up, a beam of neutrons. In both low- and high-energy accelerators the same nuclear properties are present. The difference is that scientists need much more accurate instruments when using lower-energy accelerators.

Penttila says the helium-3 polarizer, sometimes called a "spin filter," is just such a tool. Moreover, it covers a large neutron energy band, making a wide range of new physics possible.

Threat Reduction

Interconnected infrastructures

Cities are enormously complex, vulnerable on many levels to terrorist attacks and natural disasters, and they are getting bigger. As their size increases, both in area and population, so does their vulnerability and their importance to the national infrastructure, making the study of cities critical to national security.



This simulation of a toxic release in the Dallas area shows the expansion of a ground-level plume. The work is being conducted under the Lab's Urban Security Initiative.

To help emergency responders deal more effectively with large-scale disasters and to help planners prepare for them, Laboratory researchers have developed the Urban Security Initiative.

The project involves a wide range of scientists — from chemists and engineers to mathematicians and physicists — plus researchers and officials from academia and government. It links many urban subsystems — including transportation, energy distribution, weather, infrastructure damage, water distribution, ecosystems, economic activities, geology and demographics — into an integrated system that takes advantage of the Lab's powerful computing capability.

"The goal is to combine new and existing computer models, along with a World Wide Web-based communication tool, to understand how the interwoven strands of a city's fibers operate in good times and bad," said Grant Heiken of Geology and Geochemistry (EES-1).

The system under development will allow such groups as the Red Cross, local utilities and highway departments to interact more effectively during an emergency.

Understanding the urban system as a whole also can improve the long-term viability of a city, guiding its future development and expansion.

Working the bugs out

Chemical or biological terrorist attacks in urban areas present unique challenges. Once the first responders have pulled citizens to safety, the surroundings that are contaminated need to be flushed, scraped, sprayed or treated to destroy the chemical or biological threats that remain.

Such knotty decontamination issues have come under close scrutiny at the Laboratory in research by William Earl of the Department of Defense Programs Office (TSA-DoD) and Gary Selwyn of Plasma Physics (P-24), who studied two methods for decontamination of chemical and biological warfare agents.

For both biological and chemical agents, Selwyn, along with postdoctoral researcher Hans Herrmann, explored using a jet of charged oxygen feedgas, known as a plasma, to destroy many organic compounds without damaging the surfaces on which they sit.

For chemical attacks, Earl examined a group of aluminosilicates called zeolites, which will soak up chemical toxins and potentially reduce their toxicity over time.

The researchers said they have found that both methods work, but they needed refining to be useful under varied field conditions.

Biosciences

Casing the joint

Anyone who has ever had a finger joint replaced with a prosthesis knows about the trade-off involved: The implant may eliminate the pain, but at a cost of strength and agility. These small prostheses, typically made of silicone rubber, also pose wear problems and may require replacement.

Lab researchers David Devlin, David Carroll, Robert Barbero and Tom Archuleta, all of Materials Technology/Coatings and Polymers (MST-7), demonstrated that it is feasible to make such devices from carbon or carbon-reinforced composites, greatly improving joint mobility and reducing the risk of joint failure.

A prosthetic carbon hip, shown half-size on the right side of a full-size human pelvic structure, may one day replace currently used metal joints.

Carbon has been proven to be compatible with the human body and has mechanical properties similar to bone. The researchers wanted to find out whether carbon-based finger joints could be made with adequate strength and wear resistance.

They tested two carbon fiber structures, finding that one of them works best for large joints such as hips and the other provides superior strength for small joints.

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They currently are testing half-size, all-carbon prosthetic hip joints, which one day may replace hip joints now made of metal and alloys and eliminate the need for bone cement to anchor them. Ascension Orthopedic Inc. of Austin, Texas, has signed a cooperative research and development agreement with the Lab to develop all-carbon hips.

Tentacles in many fields

Some electromagnetic fields, like the one generated in the Earth, are obvious and powerful. Others, like those found in videocassette recorders, cellular phones and electric toothbrush motors, are far smaller. Still others, like those within the human body, are almost immeasurable.

These human biomagnetic fields, generated by electrical currents produced by neurons in the brain, are a billion times weaker than Earth's magnetic field and 10,000 times weaker than the field surrounding a household wire.

Researchers use Superconducting QUantum Interference Device (SQUID) sensors to measure a variety of extremely small magnetic fields. New concepts for applying SQUIDs, the most sensitive magnetic field detectors known, were developed at the Laboratory in the 1980s and are being applied in a number of areas.

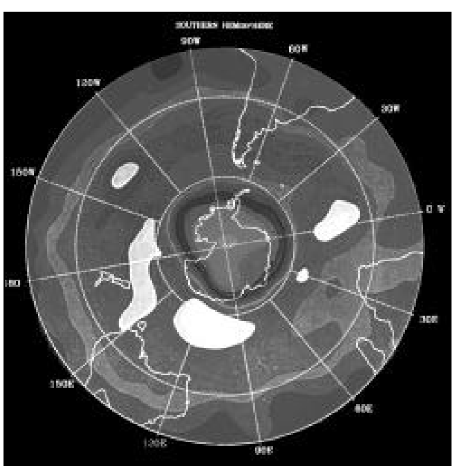
Biomagnetic research at the Lab includes work in magnetoencephalography (MEG), a method of measuring the tiny magnetic fields produced when small groups of the brain's roughly 100 billion neurons are active, and magnetocardiography, a method for measuring the magnetic fields produced by cardiac activity.

SQUIDs also are used to detect the weak magnetic fields induced by tiny electrical currents that result from corrosion in metal containers. Lab scientists have developed a prototype device capable of detecting corrosion currents in nuclear waste storage containers.

Environmental Sciences

Where has all the ozone gone?

The atmospheric ozone layer provides protection from harmful ultraviolet radiation, yet it continues to lose ozone. Determining how ozone-eating chemicals react under upper-atmospheric conditions, particularly with stratospheric aerosol particles, will help researchers understand ozone depletion.



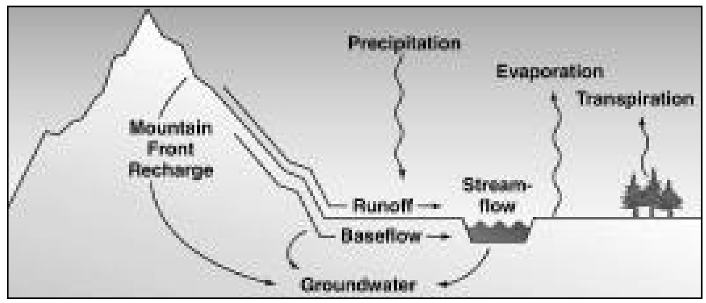
Lab researchers are duplicating on Earth conditions found in the atmosphere to learn more about ozone depletion as shown in this 1995 image of the region known as the "ozone hole" (center of image) over the Antarctic. *National Oceanic and Atmospheric Administration image*

The problem is the lack of a practical way to study stratospheric ice *in situ*. The stratosphere is very thin, with few particles to begin with. Even more problematic, aircraft cannot fly high enough to take a sample. On top of that, bringing the sample back in pristine condition is practically impossible.

So Bryan Henson and Jeanne Robinson of Chemical Reactions, Kinetics and Dynamics (CST-6) are doing the next best thing: duplicating the conditions at the top of the atmosphere in a lab.

They grow ice samples that simulate polar stratospheric cloud particles and then, using a new application of a proven laser light-scattering technique called second harmonic generation, they study the surface reactions of the ice when exposed to various gases.

In the future, Henson, Robinson and their co-workers hope to design an experiment to determine another central question: What is the exact composition of the ice?



Researchers use a Lab supercomputer to model water resources in the Rio Grande Basin. The water balance depends on complex interactions, as shown in this conceptual model. *Graphic by Lori Kleifgen*

A couple of computations

Anyone who has lived in the desert Southwest knows water is a precious commodity. Popular campaigns tout the benefits of conservation. "Agua Es Vida" (water is life) bumper stickers have become commonplace in many towns and cities.

"The whole Southwest faces a major water shortage, especially if it continues to grow as it is," says Larry Winter of Scientific Computing (CIC-19). "We're hoping to be able to contribute to the solution."

Laboratory researchers are using a supercomputer to model water resources in the Rio Grande Basin, where the water balance depends on complex interactions among regional climate, land surface, groundwater, stream networks and multiple uses of the water.

A regional assessment of the effects of possible climate change and competing uses for water resources require an understanding of the hydrologic cycle at local scales over long time periods. Modeling these systems requires coupling global-to-regional-scale atmospheric simulations with regional-to-local-scale simulations of land surface and subsurface flows.

As part of this coupled environmental modeling project, researchers have developed a computer model to simulate the behavior and spread of wildfires as well as the local and regional weather conditions that drive a fire or are driven by a fire.

In February 1998, Lab researchers observed a controlled burn at a wildlife refuge near Cape Canaveral, Fla., to gather data that led to an improvement in its Wildfire Prediction System.

Lab researchers hope that these computer models soon can help fire professionals more effectively fight fire, train firefighters and plan strategies to prevent catastrophic fire conditions.

1999 Edward Teller Medal awarded to Laboratory scientist

Larry Foreman of Polymers and Coating (MST-7) receives a phone call from Edward Teller during an award ceremony at Fuller Lodge at which he received the 1999 Edward Teller Medal. *Photo by LeRoy N. Sanchez*

Larry Foreman of Polymers and Coating (MST-7) has received the 1999 Edward Teller Medal.

According to the American Nuclear Society, the award's sponsor, Foreman "has excelled as a leader and scientist in the U.S. program to develop extremely high quality cryogenic targets for Inertial Confinement Fusion, including targets for the billion-dollar-scale National Ignition Facility now under construction."

Foreman has been involved in ICF target fabrication at the Laboratory since the early 1980s. In 1988 Foreman and Jim Hoffer of Condensed Matter and Thermal Physics (MST-10) published the seminal work on beta-layering. Their experimental results and theoretical explanation of the self-smoothing of frozen deuterium-tritium is the basis for nearly all cryogenic ignition target designs. More recently, Foreman led the effort to develop beryllium as a DT-containing target for the NIF.

The Teller Medal is a biannual award given in recognition of pioneering research and leadership in the use of laser and ion-particle beams to produce unique high-density matter for scientific research and for controlled nuclear fusion. Recipients are selected from nominations received by the International Conference on Inertial Fusion Sciences and Applications as well as the American Nuclear Society.

Foreman is the first Lab scientist to receive this award. His outstanding scientific work also has been recognized with a Laboratory Distinguished Performance Award and a Department of Energy Recognition of Excellence Award.

Steinhaus named education program office director

Kurt Steinhaus

Kurt Steinhaus has been named director of the Lab's Education Program Office. Steinhaus succeeded Dennis Gill, who retired earlier this year.

An education professional for the past 22 years, Steinhaus has worked since 1988 for the New Mexico Department of Education. Since 1997, he has served as assistant state superintendent for accountability and information services and as chief information officer.

From 1976 to 1988, Steinhaus worked for the Alamogordo Public Schools in a variety of capacities. He has been designer, director and instructor for the International Space Hall of Fame Computer Camp.

A 1972 graduate of Los Alamos High School, Steinhaus has been a member of the Lab's Northern New Mexico Council for Excellence in Education since its inception. He has worked directly with many Lab education programs over the past eight years.

During his professional career, Steinhaus has served as a teacher, department chairman, educational consultant, education program manager and division director. He holds master's degrees in both computer science and music. He earned a doctorate in educational leadership and organizational learning from the University of New Mexico. He has been trained in coalition building and managing diversity skills.

Willms elected to ANS Executive Committee

Scott Willms

Scott Willms of Tritium Science and Engineering (ESA-TSE) was recently elected to the American Nuclear Society Executive Committee of the Fusion Energy Division.

Willms, the tritium processing project leader in ESA-TSE, will serve a three-year appointment on the executive committee. Members of the American Nuclear Society elected Willms to the committee.

The Fusion Energy Division of the American Nuclear Society Executive Committee promotes the development and timely introduction of fusion energy as a sustainable energy source. The division also cooperates with other organizations on common issues of multidisciplinary fusion science and technology, conducts professional meetings and disseminates technical information in support of these goals.

A 13-year Laboratory employee, Willms has served in project and team leader roles since 1995. Most of his research and development work has been performed in the Tritium Systems Test Assembly, which is devoted to radioactive tritium processing experimentation.

He joined the Lab as a postdoctoral research associate in 1985.

Willms has bachelor's, master's and doctoral degrees in chemical engineering from Louisiana State University in Baton Rouge, La.

Kladko awarded Otto Hahn Award

Konstantin Kladko

Konstantin Kladko of the Laboratory's Condensed Matter and Statistical Physics Group (T-11) has been awarded the prestigious Otto Hahn Medal for Young Scientists by the Max Planck Society of Germany. The medal, and its accompanying stipend, was awarded to Kladko

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July employee service anniversaries

30 years
Larry Caudill, DX-8
Michael Dugan, NIS-6
Alfred Garcia Jr., ESH-OIO
William Gregory, ESA-DE
Robert Harrison, LANSCE-9
Joseph Kleczka, CIC-7
Peter Lyons, GR
Michael Nieto, T-8
James Porter Jr., STB-DSTBP
Billy Powell, DX-1
Armando Rendon, LANSCE-1

25 years
Dwight Barrus, CIC-7
Pete Chavez Jr., DX-4
Phillip Eller, NMT-11
Kenneth Freese, CIT-SP
Jeanne Hurford, CIC-15
Russell Kidman, TSA-10
Jerry Lopez, CIC-4
Harold Martinez, ESH-17
Robert Medina, DX-1
Kenneth Milder, CIC-5
Warren Miller Jr., DLDBAO
Anthony Moya, NMT-3
Vicente Rojas Jr., F-6
Eufemio Romero, NMT-8
Jay Samuels, NMT-1
Richard Sena, NIS-6
Richard Silver, T-11
Kenneth Spencer, NIS-4
J.A. Eloy Trujillo, PM-3
Leaf Turner, T-3

20 years
Leigh Brophy, CIC-9
Dana Christensen, NMT-DO
Lydia Gonzales, ALDNW
Carolyn Helland, NIS-9
Paul Johnson, EES-4
Susan Jones, NW-MM
R. Gary Lee, CIC-7
B.T. Martinez, NMT-7
Debbie Martinez, BUS-4
Patrick Martinez, TSA-10
Eugene Mroz, CST-7
R. Alan Patterson, NW-EP
Lawrence Pratt, T-12
Larry Rowton Sr., P-FM
Kenneth Stroh, TSA-10
Gregory Swift, MST-10
Darleen Vigil, BUS-8

15 years
Mabel Amador, CIC-1
Ling-Ling Chen, CIC-8
William Cottingame, EES-8
Paul Dotson, T-14
Gilberto Estrada, ESH-12
Gerald Garvey, P-25
Kathryn Gursky, NIS-8
Marcella Haber, NIS-9
Florence Hsu, ESA-WE
Ed Hyde, ESA-WMM
Merle Koepke, PM-2
David Kratzer, CIC-6
Gary Laabs, DX-4
Leon Lopez, CIC-7
Laverne Martinez, DX-1
Sally Martinez, ESH-1
James Mitchell, LC
Cora Montoya, NIS-2
Lloyd Montoya, NW-SS
Larry Rodriguez, MST-7
Eugenia Romero, HR-1
Petrita Romero, DLDOPS
Julian Sandoval, BUS-2
Al Sattelberger, CST-DO
Elizabeth Saunders, LS-3
Stanley Schriber, LANSCE-DO
Kathryn Strong, HR-6
Marilyn Thomas, LANSCE-DO
Thomas Turner, DX-1

10 years
Nancy Anderson, ESH-1
Bob Bates Jr., ESH-12
Brian Emkeit, DX-4
Richard Farman, TSA-7
Wallace Harbin II, ESA-TSE
Russell Jung, ESH-1
Laura Kelly, NMT-1
Thomas Langston, LANSCE-3
John Layne, CIC-2
Mary Lujan, S-6
Diana Martinez, ESH-1
Peter Naffziger, LANSCE-6
Subrata Nath, LANSCE-1
David O'Brien, TSA-11
Robert Perry Jr., NIS-7
Paul Reimus, CST-7
C.R. Richardson, PMDS
Jennie Richardson, NMT-10
Thomas Scheber, NW-SS
Josephine Torres, ESA-FM-ESH
Carole Travis, CIT-RBD
Pamela Trujillo, CIC-2
William Ward, ESA-EPE

5 years
Tariq Aslam, DX-1
Leo Beckstead, S-7
Phillip Berry, ESA-MT
James Biggs, ESH-20
Randy Bremmer, CIC-7
Michael Collins, NIS-5
Robert Daley, F-6
Charles Duy, F-SWO
Diana Esch-Mosher, NIS-3
Beverly Faulkner, CIC-6
Harvey Haagenstad, ESH-20
Thomas Johnson, QIO
Douglas Kautz, NMT-15
Richard Korzekwa, LANSCE-9
Tanya Lewis, NMT-15
Eric Martin, DX-1
Ernestine Martinez, ESH-18
Esther Martinez, S-6
Theresa Rudell, ESH-3
Brian Scott, ESH-1
Nadine Serrano, NMT-3
Frances Salazar, S-1
Orlinie Velasquez, CIC-2
Michael Ziehmn, MST-6

In Memoriam

Larry D. Smith

Larry D. Smith, 63, died April 2. He worked for the Lab from 1962 through 1989. He began his Lab career working for Instrumentation and Design (CMB-7) as a mechanical designer doing glovebox design for TA-55. After retiring, Smith returned to the Lab as an associate until 1991. Smith served in the U.S. Army from 1954 through 1956. He was a member of the National Rifle Association, a member of the Northern Rio Grande Sportsmen's Club and a former Boy Scout leader in Los Alamos.

William Schweitzer

Retiree William Schweitzer died April 13. He was 72. He served in the U.S. Navy during World War II. Schweitzer completed his military service in 1944. He came to work for the Lab in 1953 with Biomedical Research (H-4). He left the Lab in 1988 while working as a Lab associate. Schweitzer continued working as a chemical technician analyzing environmental samples until 1989.

Carmel A. Quintana

Laboratory retiree Carmel A. Quintana, 78, died April 28. Quintana received an accounting degree from St. Michael's College in 1957. He was a veteran of the U.S. Air Force and a Boy Scout leader for a number of years while in Los Alamos. In 1966 he came to work for the Lab with Communications (ENG-5) as an accountant. He left the Lab in 1987 while working with General Accounting (ACT-3).

William D. Purtymun

Laboratory retiree William D. Purtymun died May 19 after a lengthy illness. He was 72. In 1958, Purtymun received a bachelor's degree in geology from the University of New Mexico. Purtymun served the U.S. Navy during World War II and the Korean War. He came to work for the Lab in 1969 with Environmental Studies (H-6) and worked at the Lab for 22 years. He retired from the Lab in 1990 while working as a geohydrologist in Environmental Surveillance (HSE-8).

Kladko awarded ...

continued from Page 8

at the Society's annual General Assembly on June 9 in Dortmund, Germany.

The award recognized Kladko's work in nonlinear studies and electron correlations in condensed matter physics. As part of his doctoral studies at the Max Planck Institute for Physics of Complex Systems in Dresden, Kladko found a way to describe quantum solid-state systems — magnets, superconductors, heavy fermion systems — by effective classical models. This promising research work lead to his being named a Director's Postdoctoral Fellow in 1998.

Founded in 1948, the Max Planck Society is a non-profit scientific organization affiliated with the Max Planck Institutes. The society awards the Otto Hahn Medal annually to young scientists in recognition of outstanding scientific achievement. In addition to a stipend, the award gives winners preference for grants enabling them to conduct research abroad for one year.

Otto Hahn, winner of the 1944 Nobel Prize for chemistry, became the director of the Max Planck Society when it was established in 1948.

"Science at Home" is a publication developed by Science Education (STB-SE) to interest children, particularly those in grades four through eight, in science through hands-on activities. We are reprinting experiments from the book, along with other scientific activities, for employees to share with their families, or just to enjoy themselves.

Monster bubbles

Have you ever wished that you could blow really big soap bubbles? If big bubbles are your thing, you're in luck because in this activity you will be testing a whole variety of different tubes with different diameters and lengths to see which one allows you to blow the biggest bubble.

As you might suspect, no ordinary bubble solution will do. If you haven't already done it, first try the experiment titled "Who Makes The Best Soap Bubble?" (July 1999 "Reflections.") You'll then know the best brand of dish washing detergent to use. To help your bubbles reach enormous proportions, you will be changing your bubble formula slightly by adding glycerin or clear corn syrup to it. When chemicals like glycerin and corn syrup mix with water, they make it really thick so it can't flow very fast. This means that the water trapped in the bubble will drain to the bottom slower, making the bubble last much longer.

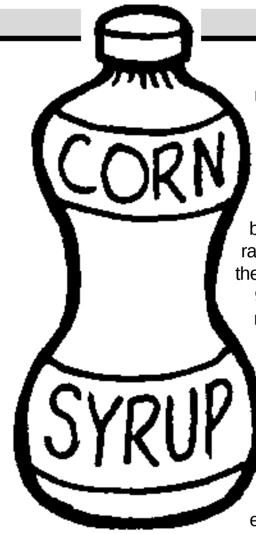
This can turn into a very messy experiment, so do it outdoors. For best results, choose a day with very little wind and lots of moisture in the air (high humidity). Also, if you let the bubble solution sit a day before using it, the results will be much better.

The stuff you'll need

A solution of 1 cup water to 1 tablespoon liquid dish detergent and five drops glycerin or clear corn syrup (glycerin is available at most drug stores); wide baking dish; heavy waterproof tape; ruler; pencil; assorted tubes: straws; toilet paper rolls; two to three empty, open-ended soup or juice cans, taped together; and a data sheet.

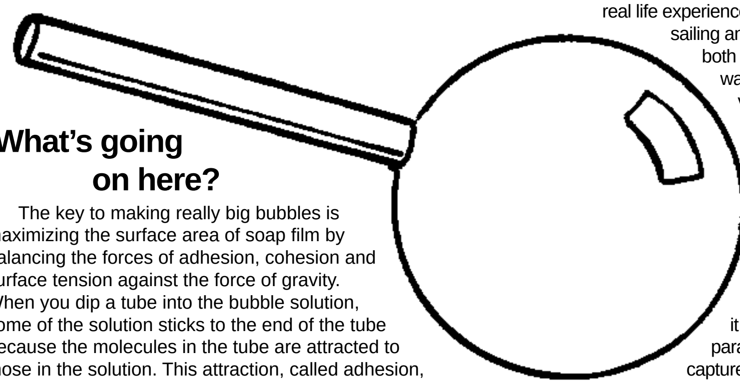
Here's the plan

1. Take all of the materials outside.
2. With a ruler, measure the diameter, the distance across the opening of each tube. Record the measurements on the data sheet.
3. Measure the length of the tube and record it on the data sheet.
4. Pour the bubble solution into the baking dish.
5. Put one end of the first blower into the solution. Swirl it around until a soap film covers the end.
6. Hold the tube straight out and blow steadily through it. Make sure you do not tilt the tube up or else you will get bubble solution in your mouth. If you need more air, be sure not to inhale through the tube. Inhale through your nose with your lips tightly closed or remove your mouth from the tube and hold the blowing end — not the soaped end — of the tube closed with your hand while you take a deep breath.
7. Release the bubble by holding your hand over the blowing end of the tube and pulling the tube away from the bubble. If the bubble does not release, flick your wrist and the tube toward your body so that the blower quickly points up.
8. After practicing your bubble releasing technique, have each member of your family blow and release bubbles from different size tubes. Describe each bubble and estimate or guess its diameter. You may want to hold a ruler up to the bubble to get a more accurate measurement. Record the results on the data sheet.
9. Which tubes seem to make the biggest bubbles? Which effects the bubble size more, tube length or tube diameter? How could you revise the experiment to prove it scientifically? Why was it important to have several family members try this experiment? Based on your data, what conclusions can you make about what is needed to make really big bubbles?



Wrap-up

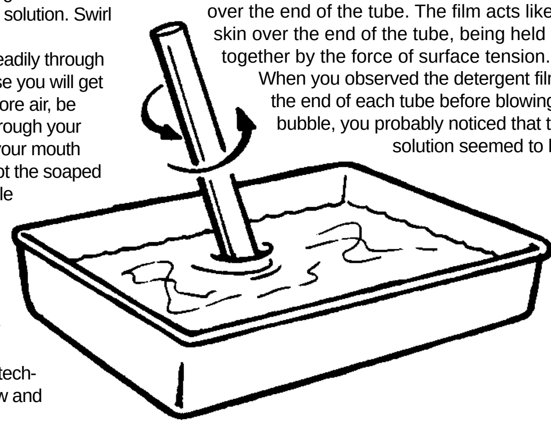
In general, the wider the tube used, the bigger the bubbles. Tube length should not have been a major factor in the size of the bubble. To test just the effect of tube length, you would have to get a bunch of tubes that are all the same diameter, but of different lengths, and compare the size of the bubbles. By having several people try it, you can compare several different sources of data. In science, the more times you conduct an experiment, the more dependable the results are.



What's going on here?

The key to making really big bubbles is maximizing the surface area of soap film by balancing the forces of adhesion, cohesion and surface tension against the force of gravity. When you dip a tube into the bubble solution, some of the solution sticks to the end of the tube because the molecules in the tube are attracted to those in the solution. This attraction, called adhesion, involves molecules of different substances sticking together. As you lift the tube slowly out of the baking dish, the detergent solution sticks to the end of the tube and clings to the solution in the pan. As a result, a detergent film is pulled up out of the pan. The force of attraction holding the solution together is called cohesion. It involves molecules of the same substance sticking together. If you lift the tube too fast, you'll break this cohesion and the film will pop. If you pull the tube up at just the right speed, the solution in the pan closes over the end of the tube. The film acts like a skin over the end of the tube, being held together by the force of surface tension.

When you observed the detergent film at the end of each tube before blowing each bubble, you probably noticed that the solution seemed to be swirling around. This swirling happens because the film is really made up of a thin layer of water molecules sandwiched between two layers of soap molecules. If you hold the tube still, the force of gravity makes the water between the soap layers flow toward the bottom of the tube. This causes the film to be stretched at the top. Eventually, it becomes too thin and breaks. By adding glycerin, you make the water thicker, so it doesn't flow as fast and the film lasts much longer. In order to get really monstrous bubbles, you must be able to trap a large volume of air inside the film without breaking the surface tension that's holding the bubble together. If you use a narrow tube, the only way you can get a large volume of air is to blow harder. Unfortunately, the harder you blow, the greater the force of the air hitting the film and the easier the film pops. By using a wider tube, you drastically increase the surface area of the bubble film touching the air. With only a gentle blow, you can move much more air into the bubble. With the wider tube, the force or pressure of the air hitting against the film is lower, and the chance of breaking the surface tension is greatly reduced.



Where does this happen in real life?

The relationship between the volume of a gas and the pressure it exerts is one of the fundamental principles in physics. This relationship is known as Boyle's Law because it was discovered in the 17th century by physicist Robert Boyle.

A good place to see it in action is in a bicycle pump. When you press down on the handle of a pump, you are taking a large volume of air and squeezing it into a narrow tube. As a result, the air comes shooting out of the pump with a great deal of pressure. Increasing surface area to capture a greater volume of air comes into play in many real life experiences, including things like sailing and parachute jumping. In both of these examples, you want to capture as great a volume of air as possible for two different purposes. While sailing, you want your boat to move even in a gentle breeze. By increasing the surface area of the sail, you can capture more wind and transfer it into forward motion. In parachuting, you want to capture air not to speed you up, but to slow you down. The large surface area on a parachute traps an enormous volume of air, which offers resistance against the force of gravity. The greater the resistance, the slower you fall.

Now try this

Once you have exhausted your supply of tubes to blow bubbles, you can branch out into heavy duty "bubble launchers" using string, rope, or even a hula-hoop. To make a simple string bubble launcher, use a piece of cotton twine about 18 inches (45.5 cm) long and two plastic drinking straws. Thread the string through both straws and tie a knot in the string. Using the straws as handles, dip the entire string into the bubble solution. Slowly, lift up on the straws spreading the string apart as you go. You should see a large film form across the string. Once the film has separated from the solution in the pan, blow through the film or hold it out into the breeze. With a little practice, you'll be launching giant bubbles in no time. To use rope or a hula-hoop, you must mix up at least a gallon of bubble solution. Put the solution in a wash tub that has the same diameter as the hula-hoop. Make a large loop out of rope approximately 5 feet (150 cm) long. This time, you'll need a couple of friends to help lift the film. If you're working alone, use a hula hoop. First, wrap the hoop in string so that the hoop will hold more solution. Dip it in the wash tub and hold it in the breeze.

This month in history

79 — Vesuvius erupts, destroying the cities of Pompeii, Herculaneum and Stabiae

1680 — Pueblo Indians revolt against Spanish colonists in Northern New Mexico

1939 — Albert Einstein writes a letter to President Roosevelt, mentioning the possibility of using nuclear fission to make weapons

1946 — President Truman establishes the Atomic Energy Commission

1953 — The Soviet Union first tests a thermonuclear weapon

1961 — East German workers begin building the Berlin Wall

1963 — Martin Luther King delivers his "I have a dream" speech at the Lincoln Memorial in Washington, D.C.

1977 — James Schlesinger is sworn in as the first secretary of energy

1980 — The trade union Solidarity, a leader of the opposition to Poland's Communist-controlled government, is formed at Gdansk

1991 — Hard-line Communists stage a coup d'etat, removing Soviet President Gorbachev from office, but give up two days later in the face of massive public resistance

1996 — The Laboratory hosts a day-long symposium to honor Fred Reines, who won the 1995 Nobel Prize in physics for research he performed while at the Lab in the 1950s

1997 — Norris Bradbury, who succeeded J. Robert Oppenheimer as Lab director and held the job for 25 years, dies

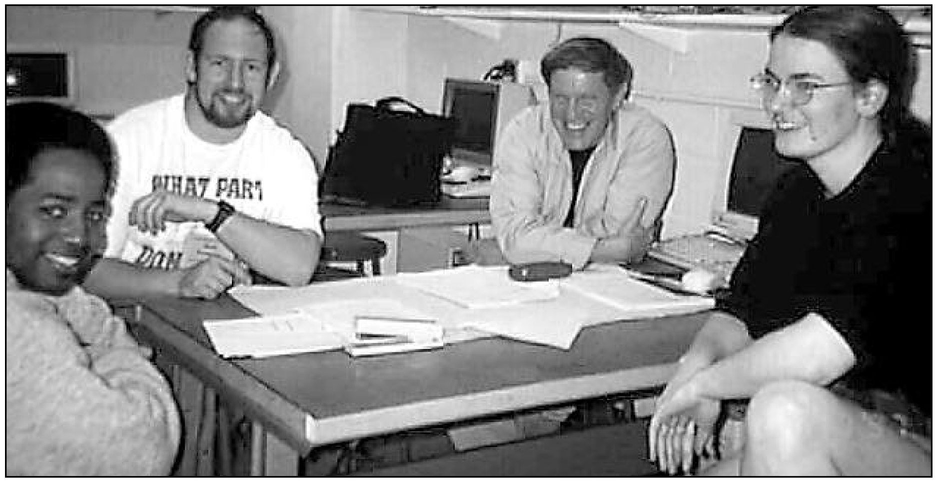
Syndicated materials

Removed at the request of the syndicate

spotlight

He who can, teaches

by Todd Hanson



Leaf Turner of Fluid Dynamics (T-3), second from right, shares a laugh with, left to right, American Association of Physics Teachers Association staff member Patrick Knox, International Physics Olympiad coach Boris Korsunsky and assistant coach Jennifer Catelli. *Photo courtesy of Turner*

Perhaps if things had gone differently in his life, Leaf Turner might have become a high school teacher. After all, his mother was a teacher.

Yet, Turner, a physicist in Fluid Dynamics (T-3), was drawn to study physics at Cornell under the tutelage of men like Philip Morrison, Hans Bethe and Robert R. Wilson. Turner studied physics with no thought of teaching as a profession. At Cornell he would begin the life-long love affair with physics that would bring him to Los Alamos and, eventually, to a position as a senior coach of the United States Physics Team for the International Physics Olympiad. Today Turner is both a physic researcher and teacher.

Turner first discovered how much he enjoyed teaching when he volunteered to teach physics at Los Alamos High School during his lunch hour. He taught from 1985 to 1991. “That became,” according to Turner “one of my most rewarding life experiences.” Since then, he has enjoyed working with students in various programs at the Laboratory and elsewhere in Northern New Mexico.

Three years ago, shortly after his son Ari received a gold medal at the 26th International Physics Olympiad, Turner joined the United States Physics Team coaching staff. It was a decision he will probably never regret, although he has discovered it’s often hard work. The selection process begins in early January of each year when high school physics teachers nominate their best students. This year more than 1,100 highly qualified high school students took the national exam. The top 200 students on this test advanced to the final round of competition and Turner was involved in the entire process.

“I work intermittently throughout the year helping to design and grade the preliminary and advanced exams. Then I work with the 24 students who make the final team for eight days at an intensive training camp in the Department of Physics at the University of Maryland,” said Turner. “These are long days of studying, testing and problem solving. It’s hard work for the kids and the coaches, but it’s a great experience.” At the end of the training camp, five students, plus an alternate, are selected for the traveling team to compete in the International Physics Olympiad.

This year’s 30th International Physics Olympiad competition was held in Padova, Italy, July 18 through 27. The American Association of Physics Teachers has organized and sponsored the United States Physics Team for competition in the International Physics Olympiad for more than 10 years. The goals of the Olympiad are to encourage excellence in physics education and to reward outstanding physics students. Turner was there to encourage, advise and support his team. That’s what teachers and coaches do.

“Of course I love physics research and I wouldn’t give it up,” said Turner, “but by teaching physics I can help students in ways I wasn’t helped in school. That’s important to me.”

So even though George Bernard Shaw once said, “He who can, does. He who cannot, teaches,” Leaf Turner disagrees. There seems no doubt that some of America’s brightest young physicists will be far better off because of it.

AAPT United States Physics Team

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