# Reflections

Los Alamos National Laboratory Vol. 5, No. 9 • November 2000

## Distinguished Performers

A Department of Energy/University of California Laboratory

## Inside this issue ...

*Cover by Ed Vigil*



editor's journal

# Something old, something new

New! Improved! Gets clothes cleaner, teeth whiter, breath fresher. Better, smaller, faster!

These are some of the superlatives that companies use to promote new or improved products.

Soon the Public Affairs Office will be rolling out its newest product. A twice-monthly publication packed with features, news and information you need to know in this complex Lab.

Employees have asked for more printed material that they can throw in a briefcase, read on a plane or at lunch, and take home to their families.

PA will be taking the monthly Reflections and making it a twice-a-month publication with a new name, packed with more news and information. The electronic Newsbulletin will continue to operate daily with breaking news and timely information.

Reflections will become the LabNews. The electronic Newsbulletin and the LabNews will be complementary publications aimed at providing the work force with information that is important, interesting, useful and entertaining.

The new improved publication will present information that showcases employees and Lab accomplishments. It will feature science stories and sport regular items such as regional and community outreach, human resources news, policy and procedure changes, UC news and DOE highlights.

The cost will not significantly change. We are reducing the number of pages per issue and changing the type of paper we use. The new publication will have a new look and a new layout.

The front page will no longer be devoted to a photo or graphic, it will have text and an illustration that goes with the story. There will be no more editor's columns from me. We will invite guest editorials. The first issue will hit the streets around Nov. 16 and then run every other week.

We look forward to serving employees with more news. We invite your comments or suggestions. Please send them to newsbulletin@lanl.gov, or you may use interoffice mail at C177 or call 7-1455.

The Public Affairs staff hope you will enjoy the publication, but we can't promise fresher breath or whiter teeth.

Kathy

Safety First

## All days are "Safety Days"

**Reflections**

**Reflections, the Laboratory monthly publication for employees and retirees, is published by the Public Affairs (PA) Office. The staff is located at TA-3, Building 100, and can be reached by e-mail at *newsbulletin@lanl.gov*, by telephone at 7-6103, by fax at 5-5552 or by regular Lab mail at Mail Stop C177. The individual telephone numbers are listed below.**

**Editor:**
Kathy DeLucas, 7-1455

**Managing editor:**
Denise Bjarke, 7-6103

**Graphic designer:**
Edwin Vigil, 5-9205

**Photographer:**
LeRoy N. Sanchez, 5-5009

**Contributing writers:**
Leah Gardner
Jennifer Graham, IM-1
Ternel N. Martinez
Ann Mauzy, IM-1
Eileen Patterson, IM-1

**Editorial coordinator:**
John A. Webster, 7-5543

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# Distinguished performers make a mark

From verifying the contents of nuclear materials containers to revalidating weapons systems, from identifying proteins to testing materials for an advanced accelerator, from developing an environmental restoration baseline to improving diesel engines, and from a symposium in Santa Fe to a technology demonstration in Washington, D.C., Laboratory employees made their marks in 1999.

For these achievements, and many others, nine individuals, three small teams and three large teams received Distinguished Performance Awards.

Individuals or small teams were recognized for making an outstanding contribution to the Lab's programmatic efforts or status in the scientific community. Large teams performed at levels far above normal job assignments, resolved problems that have broad impacts and exhibited a high degree of skill, teamwork and dedication.

*Photos by LeRoy N. Sanchez of Public Affairs (PA)*
*(assisted by Mike Kolb of the Community Relations Office (CRO) and Ternel N. Martinez of PA)*

*Text by Jennifer Graham, Ann Mauzy and Eileen Patterson of Communication Arts and Services (IM-1)*

## Individual awards

### *Nancy Ambrosiano, PA*

*Nancy Ambrosiano, PA*

The Department of Energy's high-visibility 1999 Technology Demonstration for Congress, known as the "Hill Demo," showcased the capabilities of DOE as a whole to an audience that included key members of Congress, federal officials and the media. Demonstrations, displays and explanations focused on technologies and initiatives that counter proliferation activities.

Nancy Ambrosiano of Public Affairs (PA) played a lead role in the overall coordination of the event. Her enthusiasm, interpersonal skills, competence and ability to identify and solve problems before they even arose won the respect and cooperation of the technical contributors, participants and program officials from all the national laboratories and DOE organizations.

Beyond coordinating the program and developing its theme, Ambrosiano participated in selecting the technologies for inclusion in the event. She wrote synopses of technologies, fact sheets to accompany displays and copy for posters. She also proposed, developed and led training sessions for all of the presenters, with the goal of packaging the information in a way that would capture the imagination of the nontechnical audience.

Much of the success of this massive effort to best present the nation's technical capabilities is attributable to Ambrosiano's contributions to every aspect of the program.

### Noline Clark, C-18

*Noline Clark, C-18*

In partnership, DOE, the national labs and the automotive industry seek more energy-efficient and environmentally friendly transportation systems for the future.

One specific effort is to reduce nitrogen oxide emissions in diesel engines. At present diesel engines do not have catalytic converters for nitrogen oxides in their exhaust systems because no effective catalysts for these "lean-burn" engines have been available.

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Distinguished performers ...

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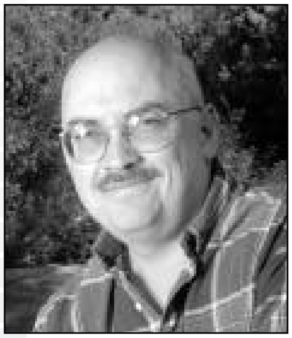
Noline Clark of Actinide, Catalysis, and Separations Chemistry (C-18) has prepared and analyzed a vast number of compounds for the potential control of nitrogen oxides. As a result, she has turned up a family of catalysts that are exceptionally active and maintain this activity over a very broad temperature range, something not seen in any other such catalyst materials to date.

Clark's discovery of effective new catalysts has led to patent applications and a significant increase in the funding at the Laboratory for this project. She has been instrumental in placing Los Alamos in the technical leadership role for this multi-lab, multi-company project.



*Michael Garcia*

## Michael Garcia, ESA-WE

Michael Garcia, formerly of Engineering Analysis (ESA-WE), was the Engineering Project Leader for the dual revalidation of the W76 weapon. Part of his responsibility was to meet milestones in the design, assembly and fielding of flight-test units for this Navy weapon.

The Laboratory committed to an aggressive schedule for two units to be flight-tested on a submarine ballistic missile in January 1999. It was the first time that an instrumented warhead — with faithfully simulated materials and shape — was launched from a ballistic missile submarine.

In meeting the deadline, Garcia coordinated work with DOE, Sandia, Pantex, Lockheed Martin, Y-12 and the U.S. Navy. He proved his professionalism and dedication when last-minute details in the assembly of the units required him to work at Pantex during the entire Christmas holiday shutdown.

The units were delivered on time. The resulting shock and acceleration test data were unprecedented and valuable. The success of the test has laid the groundwork for future instrumented flight tests of other Laboratory weapon systems. More important, Garcia has enhanced the Laboratory's credibility with an important customer, the U.S. Navy.

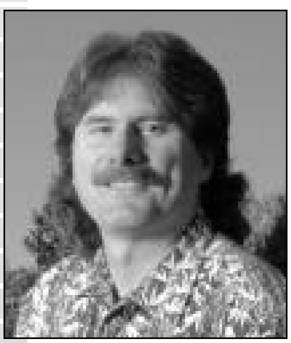
*Sandra Kelley*

## Sandra Kelley, LANSCE-DO

Los Alamos hosted the prestigious Tenth International Symposium on Capture Gamma-Ray Spectroscopy and Related Topics in Santa Fe in the fall of 1999. When the original conference secretary left the Laboratory in 1998, Sandra Kelley took control of the situation. While continuing to function as a secretary in the Los Alamos Neutron Science Center (LANSCE) Division Office, she got conference planning back on track.

Operating far beyond her normal job requirements, Kelley coordinated the conference's scientific program, participated in Local Organizing Committee meetings (tenaciously keeping the committee on schedule), assisted with and documented the speaker selection and invitation processes, and coordinated the speakers' detailed travel and payment arrangements. She also took charge of assembling, editing and publishing the book of abstracts and the 1,000-page conference proceedings, wrestling materials submitted in numerous computer platforms. During the conference itself, Kelley seamlessly addressed potential problems.

The success of the 1999 conference, the best in the 30-year series according to the keynote speaker, is a tribute to Kelley's dedication, ability and enthusiasm. According to a Local Organizing Committee member, "Kelley inherited a real problem and solved it. Few others could have done so, and none could have done better."



*James Lake*

## James Lake, ESA-MT

Like other weapon systems, the W76 is designed to meet the requirements of a stockpile-to-target sequence, or STS, document, which spells out the expected acceleration, shock and thermal environments the weapon will experience during launch, separation, flight and reentry.

In February 1999 the Laboratory, Sandia, Pantex, Lockheed and the U.S. Navy conducted one of the infrequent and expensive flight tests of the W76, fully instrumented with shock and vibration accelerometers and temperature sensors. Data would be analyzed and then compared with the STS requirements.

*Theresa Romero*

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James Lake's job was to interpret the test data, 15 CD ROMs of it, but the measurements came in highly contaminated with noise and significant errors. Lake, of Measurement Technology (ESA-MT), devised a highly creative algorithmic approach to recover and assess the data. Lake has thus laid the groundwork for analysis of future flight tests. His highly credible analysis resulted in a recommendation to reassess certain aspects of the STS and even uncovered a new event that may be included in a revised STS document.

## Theresa Romero, BUS-7

The superb leadership of Theresa Romero of Business Systems Support (BUS-7) allowed the Laboratory to develop its Budget Allocation and Funding Modules. She was also instrumental in developing the Resource Planning Module. These three critical business systems allow the Laboratory to forecast expenditures and perform analyses for program management. Perhaps Romero's greatest challenge was reaching a consensus on the proper business rules for Laboratory budgeting. Her success has earned rave reviews from the budget analysts who use the new systems.

Romero has a genuine concern for those who use Laboratory financial systems. She seeks broad customer input, incorporates solutions to user needs and ensures that users are well trained. She is an advocate for the users, often taking difficult and unpopular stands on their behalf. Romero's meticulous approach to systems testing and implementation has resulted in a very satisfied set of systems users.

Romero has positively affected the work environment of every Laboratory financial employee, enabling each one to more efficiently, effectively and consistently understand and define the budget positions of the Laboratory's organizations. She continues to be a vital resource to the entire BUS Division staff.

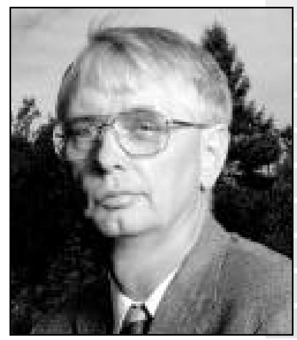
*Geoffrey Waldo*

## Geoffrey Waldo, B-N2

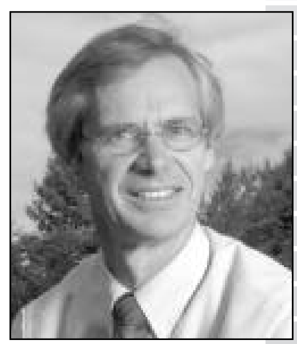
The biotechnology industry and fields such as structural biology and biochemistry often require high concentrations of protein molecules. However, when synthesized in large quantities, many protein molecules fail to fold into their correct three-dimensional configuration. A researcher has two problems — identifying the correctly folded proteins and synthesizing enough of them to supply the work at hand.

Geoffrey Waldo of Bioscience (B-N2) solved these problems by fusing a green fluorescent protein with a target protein. The GFP fluoresces only in the presence of successful folding and so "reports on" the proper folding of the target protein to which it is joined. Identification of properly formed molecules can be done visually. In addition, Waldo has used his reporting system to develop a method for engineering poorly folding proteins into properly folding ones.

Waldo's work has already resulted in a DOE-funded project and is the basis for a $5 million a year proposal to the National Institutes of Health. It also has great commercial potential and is currently being evaluated by numerous academic institutions and pharmaceutical companies.



*Gordon Willcutt Jr.*



*Lloyd Young*

## Gordon Willcutt Jr., TSA-10

One facet of the Accelerator Production of Tritium (APT) Program is the testing and qualification of candidate materials for the proposed APT facility. Gordon Willcutt of Nuclear Systems Design and Analysis (TSA-10) is the principal investigator for the thermal-hydraulic design and analysis of these materials under expected irradiation conditions.

The tests themselves are complicated. One example, an experiment to evaluate corrosion, included five different metal alloys represented in 12 custom-designed probes. The fabricated probes were not uniform, but their fabrication represented thousands of work hours and nearly $100,000 in materials costs. As is typical of Willcutt's attention to precision, he undertook to redo all the thermal-hydraulic calculations and to suggest how the experiment could be reconfigured to use the probes on hand and still gain meaningful information.

Another example is Willcutt's design of the sample holders and flow conditions for more than 5,000 materials samples, the largest suite of materials irradiated at one time in a

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*Prototype Inspection System with Information Barrier Development and Demonstration Team*

*HIV Genetic Analysis Team*

*Multiphase Flow Project Team*

Distinguished performers . . .

*continued from Page 5*

high-power accelerator environment. This work established the temperature of the samples during irradiation, an absolutely critical parameter for experiments in radiation-damage research.

## Lloyd Young, SNS-DO

The science of accelerators is being advanced worldwide for applications including basic research, nuclear waste disposal, and tritium and medical radioisotope production. A radio frequency quadrupole is a component of all new proton accelerators. One technical challenge in producing high energy and power in an RFQ accelerator is keeping the required RF electric field distribution stabilized, or "tuned," over the length of the RFQ. Lloyd Young of the Spallation Neutron Source Project (SNS-DO) is credited with two innovative advances in the state of the art of RFQ technology that make this possible.

Young is largely responsible for the design, tuning and testing of the Low-Energy Demonstration Accelerator for the Accelerator Production of Tritium Project and for the commissioning of its special RFQ. He designed a segmented resonant cavity so that tuning is accomplished over each short segment, and he developed an innovative tuning method that is now used in advanced accelerator projects worldwide.

The LEDA has accelerated the highest proton beam current and produced the highest resulting continuous-wave proton beam power ever achieved. Young's work has confirmed that Los Alamos is preeminent in the international accelerator community.

# Small teams

## Prototype Inspection System with Information Barrier Development and Demonstration Team

Under the Trilateral Initiative between the United States, the Russian Federation and the International Atomic Energy Agency, a technical working group set out to solve a fundamental arms-control inspection problem. How can inspectors examine containers of nuclear materials for proof of compliance with disarmament requirements without simultaneously violating laws protecting classified information? In August 1998 this team proposed an "information barrier," a hardware/software suite that measures and displays certain attributes of fissile materials while withholding classified details.

The concept interested the Trilateral working group, but it needed proof of usable instrumentation. To achieve that goal, the Los Alamos team launched a crash program. Working with a supporting cast from Lawrence Livermore National Laboratory and other DOE labs, the team built a custom mini-computer, wrote software and integrated nondestructive assay instruments. In June 1999 it demonstrated a successful, fully functional prototype.

Now accepted as IAEA's preferred approach, the team's system is a groundbreaking arms control technology that will strengthen arms control verification.

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Team members are Nancy Jo Nicholas, William (Chip) Johnson Jr. and Lawrence Sprouse of Advanced Nuclear Technology (NIS-6); Diana Langner and Duncan MacArthur of Safeguards Science and Technology (NIS-5); and Rena Whiteson of Safeguards Systems (NIS-7).

## HIV Genetic Analysis Team

Knowing when the HIV virus was first contracted by humans is critical to understanding how it is transmitted and how rapidly it has evolved in the population. By applying a combination of innovative methods in statistics, biology and advanced computing to newly available HIV genetic sequencing information, this team determined that the virus first jumped to humans in approximately 1931.

The group studied DNA from modern HIV samples spanning 17 years, created HIV family trees with branches indicating genetic mutations and developed computer codes that correlated distances between branches to extrapolate back to the epidemic's origin.

The implications of the group's results are dramatic and contribute to our knowledge about the early history of the HIV epidemic. They also provide basic general methods for the study of pathogens. Furthermore, the results add to the mounting evidence contradicting the controversial theory that the AIDS epidemic was introduced in the 1950s through a contaminated polio vaccine used in Africa.

Team members are Bette Korber of Theoretical Biology and Biophysics (T-10), Tanmoy Bhattacharya and Rajan Gupta of Elementary Particles and Field Theory (T-8), Alan Lapedes of Complex Systems (T-13) and James Theiler of Space and Remote Sensing Sciences (NIS-2).

## Multiphase Flow Project Team

The Multiphase Flow Project, funded by a Fortune 100 industrial partner, involved plans to develop simulations of parts of a manufacturing process for a proprietary consumer product by expanding and tailoring an existing Laboratory code, CFDLIB. This Laboratory team greatly exceeded the original project goals and technical objectives by providing the capability to use complex three-dimensional multiphase simulations to study the entire manufacturing process and all of its components and materials, including the effects of complex geometry and internal moving parts. The simulation capability significantly reduces the costs of troubleshooting problems with existing processes and of designing new processes.

The team's technical results and its superb ability to transfer complex technology have had a significant impact on the industrial partner's engineering culture. This impact includes an expanded vision of potential applications for computer-aided engineering and significant changes to corporate engineering processes. The team also has influenced the direction of research and development at numerous industrial and scientific institutions, including Purdue University, an educational collaborator on this project.

Team members are Norman Johnson, Bryan Kashiwa, Nely Padial-Collins and W. Brian Vander Heyden, all of Fluid Dynamics (T-3).

# Large teams

## Enhanced Surveillance Synchrotron X-ray Project Team

In 1999, to study the local atomic structure of plutonium-gallium alloys, the Laboratory needed to use the specialized X-ray probes at the Stanford Synchrotron Radiation Laboratory. Such SSRL studies provide data relevant to nuclear materials aging.

This team synthesized and fabricated the PuGa samples for the tests, packaged and shipped the samples, developed the health and safety procedures for working at a nonnuclear facility and performed the measurements at Stanford.

Preparing the samples was a formidable task. The synchrotron requires small, thin samples that can be difficult to create while

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***Enhanced Surveillance Synchrotron X-ray Project Team***

*Environmental Restoration Baseline Development Team*

*continued from Page 7*

preserving the metallurgical structure and avoiding undesirable inclusions. Measuring the samples at SSRL was equally challenging, calling for rapid equipment calibration and installation, frequent sample changes and around-the-clock monitoring of the beamline. Team members worked in shifts.

In addition, SSRL beamtime for radioactive samples is scheduled months in advance and cannot be changed or extended. A breakdown at any point would have meant a seven-month delay.

The team overcame all challenges, and the resulting tests revealed previously unknown details about PuGa structures. That information will assist the Laboratory in meeting enhanced stockpile surveillance objectives, including making lifetime predictions for stockpile weapons.

## Environmental Restoration Baseline Development Team

The multiyear, $1.5 billion Environmental Restoration (ER) Project is a highly visible Laboratory project of such importance that DOE has made its success a condition of the special provisions of the DOE/University of California contract. A poor ER rating for the Laboratory could threaten the UC contract. In FY99, 25 percent of that rating depended on validation of a new lifecycle baseline (beginning with FY00) for the ER Project. This team was responsible for developing that baseline.

The lifecycle baseline is extremely complex, addressing the Laboratory's potentially contaminated sites and consolidating them into units related to eight major watersheds.

Within these combined units, the baseline team prioritized the sites for investigation, assessment, stabilization and remediation, placing high-risk work first. The team's finished baseline is 21 volumes that detail the project planning, resources and scheduling necessary to complete the ER Project. The baseline's approach, complexity and comprehensiveness far exceeded DOE's expectations and helped Los Alamos achieve an "Excellent" rating on the FY99 Appendix F Performance Measures. In addition, it reduced the ER Project's completion date by three years and its total cost by about $2.6 billion.

## W87 Mechanical Safe and Arm Device Production Team

The production of detonators for the W87's mechanical safe and arm device — part of the warhead's primary system — was transferred to Los Alamos from the closed Mound facility in Miamisburg, Ohio. The MSAD detonator is a pellet of high explosives pressed into a tiny aluminum can, the entire assembly being no bigger than an aspirin

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*W87 Mechanical Safe and Arm Device Production Team*

# Bishop winner of internationally recognized award

*Alan Bishop*

Later this year, Alexander Von Humboldt Research Award winner **Alan Bishop** will make the first of several visits to the University of Bayreuth, Germany, to study and teach. Bishop is among five researchers recognized this year in the theoretical field by the Alexander Von Humboldt Research Association.

This internationally recognized award allows each winning scientist to carry out research in a field of his or her choice at a research institute in Germany. Each has the option of spending four to 12 months at that specific institute over a period of several years.

Bishop has been with the Lab for 20 years, serving as group leader for Condensed Matter and Statistical Physics (T-11) and, since July 1999, as director of the Theoretical (T) Division. He completed his undergraduate studies at Cambridge University. He was a junior research fellow at Oxford University and a postdoctoral fellow at Cornell University. Before coming to Los Alamos in 1979, he taught at London University for three years.

Bishop was recognized by the association for his achievements in the field of complex systems in the context of condensed matter materials science. His accomplishments include being a founding member of the Center for Nonlinear Studies at the Laboratory.

“We have entered a new era of complex materials driving new science,” he said. “We have to invent new science tools to understand the new materials. Our previous scientific basis was incomplete.”

Bishop said the Lab is a leader in the complexity field because employees can work in an interdisciplinary way. “This ability is profoundly important and facilitates the process of meeting the Lab’s mission of controlling and using complex systems,” he said.

“Complexity is a symbol of a new age,” he said. “We need to recognize, understand and use complexity instead of trying to avoid it.”

# *October employee service anniversaries*

**40 years**
Roland Hagan, NMT-4

**30 years**
Lawrence Ortiz, ESH-5

**25 years**
James Tape, ALDTR
Jeanette Ortega, BUS-3
George Ortega, BUS-4
Kenneth Hanson, DX-3
Karl Mueller Jr., DX-3
Earl Spoeneman, EES-7
Richard Garcia, ESA-FM-ESH
Burt Davis, ESA-WE
Steve Lauer, ESA-WMM
Nancy Greene, ESH-IMPT
Phyllis Russo, NIS-5
Lorraine Vigil, NMT-11
Samuel Wilson, P-21
Norman Kurnit, P-24
Thomas Short, PM-DS
Elmer Archuleta, S-3
James Gubernatis, T-11

**20 years**
Jonathan Longmire, B-N1
J.S. Vigil-Sandoval, BUS-1
Lucille Lucero, BUS-8
Anthony Garcia, C-1
Gloria Norris, CIC-2
Betty Martinez, DX-1
Terry Rust, E-ET
Roy Michelotti, ESA-DO
Charles Brehm Jr., ESA-WMM
Drusilla Price, FWO-S2CM
Jon Kapustinsky, LANSCE-DO
William Ingalls, LANSCE-2
Dwight Rickel, MST-NHMFL
Peter Gobby, MST-7
Eloisa Michel, NIS-1
Steven Bender, NIS-2
Dennis Dick, NMT-DO
Mark Devolder, NMT-14
Michael Burkett, X-4

**15 years**
Yvonne Rogers, B-N2
Eliza Sanchez, BUS-2
Nancy Vargas, BUS-2
Raymond Catanach, BUS-3
Mildred Valdez, CIC-10
Marie-Louise Hadden, CIC-15
Erna Medina, CIC-18
Cynthia Kelley, CIC-2
Richard Catanach, DX-1
Kathryn Smith, DX-1
Dean Doty, DX-5
Dennis Hjeresen, E-DIV
Everett Springer, EES-15
Kay Birdsell, EES-5
Peter Prince, ESA-DE
Douglas Aikin, ESA-TSE
Robert Stokes, ESH-1
G.P. Hardekopf, ESH-2
Beryl Cruz, ESH-5
Douglas Hefele, FWO-SEM
Emilio Racinez, FWO-UI
John Russell, IBD
Alfred Maestas, LANSCE-2
Michael Nastasi, MST-8
Gregory Sheppard, NIS-NAC
Ernest Callis, NMT-1
Howard Nekimken, NMT-2
Patrick McGaughey, P-25
Robert Stuewe, QIO
Dorothy Garcia, T-CNLS
Angel Garcia, T-10
Arthur Voter, T-12
Kenneth Werley, TSA-3
Terry Helm, TSA-7

**10 years**
James Bossert, ALDTR
Juvela Naranjo, ESA-TSE
David Kraig, ESH-17
Chad Olinger, NIS-7
Ann Schake, NMT-5
Richard Trujillo, NMT-8
Daniel Pava, PM-1

**5 years**
Hsing-Lin Wang, B-S2
Andrea Salazar, BUS-8
Timothy Cleland, CIC-ACL
Paul Rightley, DX-3
Kalpak Dighe, EES-8
Mary Webb, ESH-20
Victoria George, FWO-DO
Dani Romero, ISEC
Kathryn Baker, LC-LEL
James Valdez, MST-8
Sandra Bonchin, NMT-1
David Kolman, NMT-15
Jean Butterworth, P-DO
Heinrich Roder, T-1
Kim Simmons, X-11
Maria Rightley, X-7

## *W87 Mechanical Safe ...*

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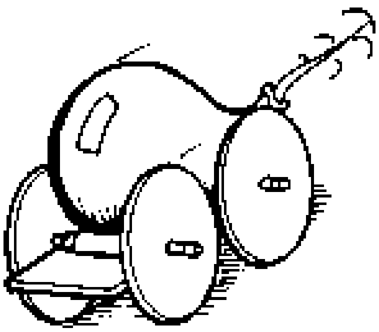
tablet. This is one of the first full-scale production efforts the Laboratory has undertaken, and this team shouldered the job.

It was a job that became more difficult when new specifications from Lawrence Livermore National Laboratory, the design agency, disqualified the first Laboratory-produced detonators. The problem? Imperfections in the high-explosive powders and aluminum from Mound.

With no time to acquire new materials and still meet the delivery deadline, the production team had to make the raw materials suit the task. To do this, the team created special samples and sent them to Livermore for test firing. With the resultant data, the team was able to work with Livermore to write new, scientifically based specifications that both suited the available materials and produced a successful product ahead of schedule.

# science fun

***"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.***



## Balloonmobile

What do giant squids and the Concorde airplane have in common? Both use the same type of jet propulsion system to get moving. Jet airplane engines suck air in, compress it, and shoot it out the back at high speed. This action causes a reaction and the plane moves forward. For squid, the medium is not air, but water. Inside the animal's body is a small space surrounded by muscle. When the squid wants to make a rapid exit, the muscles contract and water shoots out a small opening. The forward action of the water causes a reaction, only this time, the motion is in reverse, shooting the squid backwards!

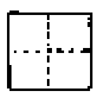


diagram 1

Used in many different applications, jet propulsion takes advantage of one of the fundamental laws of physics first described by Sir Isaac Newton in the late 1600s. In this activity, you will use the same principle to construct a balloon-powered racing car. By manipulating the position of the balloon and the amount of inflation, you will discover how to maximize your vehicle's performance, and you will learn about efficient energy transfers.

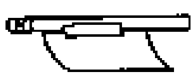


diagram 2

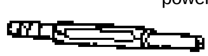


diagram 3

## *The stuff you'll need*

A piece of 8 1/2" by 11" notebook paper cut into four equal pieces (diagram 1); two unsharpened pencils; eight rubber bands; tape; a rectangular piece of cardboard 4" by 10" (10 cm by 25 cm); scissors; one round or long balloon; four 6" paper plates or circles cut from cardboard; one sharpened pencil

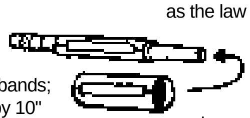


diagram 4

## *Here's the plan*

1. Take one of the four equal pieces of paper (diagram 1) and tape the short side to an unsharpened pencil (diagram 2).
2. Tightly roll the entire piece of paper around the pencil and tape the loose end down the whole length of paper (diagram 3).
3. Put a second piece of paper on top of the first, but don't tape it. Roll the paper around the pencil, but make it looser than the first one. Tape the second piece of paper down to itself so that it doesn't unravel.
4. Remove the pencil so that you are left with an empty tube. The empty tube is an axle roller.
5. Slip the wrapped pencil into the axle roller. If it slides easily, it is fine. If it doesn't slide easily, make a slightly bigger axle roller (diagram 4).
6. Repeat steps 1-5 to make a second axle roller.
7. Slide a wrapped pencil into each axle roller.
8. Tape the axle rollers with the pencils inside of them onto the ends of the cardboard rectangle (diagram 5). The pencils should be centered across the short side of the cardboard and stick out evenly over the edges.
9. Poke a hole through the center of each paper plate with a pencil point to make the wheels.
10. Wind a rubber band tightly around each pencil about 1/4 inch (1cm) from each end.
11. Slide the wheels over the ends of the pencils (diagram 6).
12. Wind another rubber band tightly around each pencil end, securing the wheel between the rubber bands.
13. Make a loop out of a piece of tape, sticky side out. Tape it to the middle of the cardboard on the same side as the axle rollers.
14. Blow up the balloon. Hold it firmly between your fingers, sealing in the air. Lay the balloon on the cardboard. If the balloon touches the wheels, let out a bit of air.
15. Gently press the balloon onto the loop of tape on the cardboard. The opening of the balloon should point away from where you want your race car to go.
16. Let go of the opening of the balloon and observe the results.
17. What happens to the air in the balloon when you let go? What happens to the car? What controlled the direction of the car? What was the action and what was the reaction? How can you change the distance the car travels?

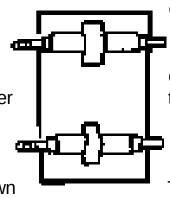


diagram 5

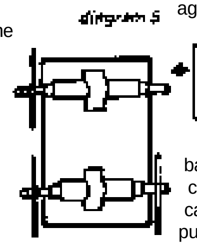


diagram 6

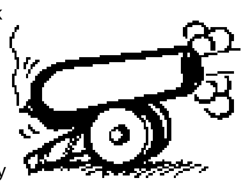
## *Wrap-up*

When you let go of the balloon, the air rushed out of the opening, propelling the car forward. The action was the air moving out of the balloon and the reaction was the movement of the car. You can control the distance the car moves by either increasing or decreasing the amount of air in the balloon.

## *What's going on here?*

As noted in the introduction, your balloon car was powered by the same type of jet propulsion that moves most of today's airliners. The underlying principle is described by Newton's Third Law, which states that whenever one object exerts a force on a second object, the second object exerts an equal and opposite force on the first. Commonly known as the law of action/reaction, it not only explains why jet engines work, but it explains why a baseball flies off a bat when hit and a rifle recoils when it's fired. After observing many moving objects, Newton concluded that whenever two things come in contact, all of the forces (pushes or pulls) working between them must equal each other out. He figured that no matter how the forces got there, they were shared evenly.

When we say that for each action, there is an equal and opposite reaction, we are really saying that in a moving system like your balloon car, everything exerts a force on everything else it touches. In the case of your balloon car, there are three different sets of action/reaction that get it moving. The initial action comes when the balloon pushes against the air rushing out of the opening after you let it go. The moving air in turn causes a reaction by pushing back on the balloon making it move in the opposite direction. Since the balloon is taped to the car, the moving balloon caused another action by pushing on the car and the car reacts as it slowly moves forward by pushing back on the balloon. The force of the moving car created a third action making the wheels push against the floor. And although you can't see it happening, The floor reacts by pushing back against the wheel, which finally makes the car move.



With all these forces acting and reacting, where does the energy come from to get the whole system working in the first place? To understand this, we must first look at how energy can be changed from one form to another. In general terms, energy can be thought of as the stuff that makes things move. Energy comes in two basic forms, potential energy, which is energy that has been stored, and kinetic energy, which is energy already in motion. When you blow up the balloon, your lungs and diaphragm use kinetic energy to compress the air inside the balloon. While trapped in the balloon, the air has no kinetic energy because it's not making anything move. It does have potential energy, however, because it is compressed and it wants to expand. By letting the air flow out the opening, you change the potential energy into kinetic energy, and the car moves forward.

## *Where does this happen in real life?*

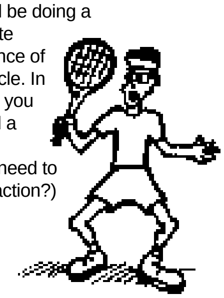
Virtually everything that moves must have the ability to transfer potential energy into kinetic energy. In living things, the potential energy comes from food, which is used as a fuel during respiration. You may not realize it, but when you eat a bowl of cereal in the morning, you are really gaining potential energy. As you move about, some of that potential energy is converted to kinetic energy. If your potential energy reserves get too low, you must eat some more to refuel your body.

With regard to Newton's Third Law of motion, action/reaction pairs are happening all around us and most people don't even notice. If you think about it, everything you touch also touches you back. If you hit a tennis ball, you may notice a slight rebound of the racket. Because a tennis ball doesn't weigh much, however, your reaction is rather small. Suppose instead you tried your best return smash on a cannon ball that was fired at you. As you might imagine, the reaction would be much more pronounced.

Probably the best place to see action/reaction pairs happening is not on Earth, but in space where weightlessness puts many things on equal footing. Every once in a while, space shuttle astronauts are called upon to take a trip outside the ship to either corral a renegade satellite or loosen a piece of equipment that has jammed. Unlike on Earth, they have to be extremely careful about how much force they exert on a stationary object. One wrong push can actually send them flying backwards for a considerable distance in the opposite direction.

## *Now try this*

Once you have gotten your balloon car up and running, try modifying it to see how you can increase either the distance or speed. Will adding a bigger balloon increase the push significantly? What about changing the wheels so that they have less friction with the floor and in the axle? Remember to keep track of all your design changes, and test only one variable at a time. That way, you will be doing a controlled experiment and can isolate exactly what changed the performance of the vehicle. In the end, you can hold a balloon car race, pitting different designs against each other. All you need to do now is take action! (Or is that reaction?)



## This month in history

### *November*

**1789 —** Thanksgiving is first celebrated as a national holiday

**1911 —** The first bombs dropped from an airplane are used by Italy on an oasis in Libya

**1935 —** Parker Brothers launches the game of Monopoly

**1938 —** Kristallnacht (“Night of Crystal”), an outbreak of destruction and violence against Jewish people and property, marks a major escalation in the persecution of Jews by the Nazis

**1942 —** Undersecretary of War Robert Patterson approves acquisition of the Los Alamos Ranch school for a new weapons research laboratory

**1943 —** A one-room library is opened in the Big House, operating on the honor system

**1949 —** Western Electric, a subsidiary of AT&T, takes over operation of Sandia Base, later named Sandia National Laboratories, from Los Alamos Laboratory

**1956 —** Soviet Premier Nikita Khrushchev tells Western countries: “History is on our side. We will bury you.”

**1975 —** The ore carrier Edmund Fitzgerald breaks in two during a storm on Lake Superior and sinks with no survivors

**1982 —** The Vietnam Veterans Memorial is dedicated on the Mall in Washington, D.C.

**1996 —** Hazel O’Leary announces her resignation as secretary of energy

**1999 —** Elián González is rescued off the coast of Florida after drifting at sea for two days in an inner tube

# Syndicated material

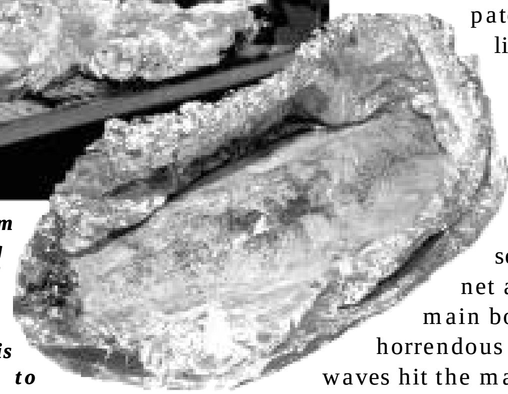
# Removed at the request of the syndicate

# Fishing for college money

*by Ternel Martinez*

It was his desperate need for college money that lured Kane Fisher of Tritium Science and Engineering (ESA-TSE) to Kodiak, Alaska, in the summer of 1990 to try commercial fishing. Why this job? Simply, Fisher had read that people could make a lot of money doing it.

Arriving with a mere $50 in his pocket and absolutely no fishing experience, Fisher spent the next one and one-half days walking from dock to dock seeking employment. Someone eventually gave him a chance, and for every summer since, he's been catching everything from salmon to herring to black cod to halibut.



***Kane Fisher, left, of Tritium Science and Engineering (ESA-TSE) and ESA-TSE colleague John Valdez grill two huge king salmon that Fisher brought back from his most recent fishing trip to Alaska.*** *Photos by LeRoy N. Sanchez*

Fisher, who is half-Eskimo, is one of six children and one of three who were adopted by now-retired Los Alamos schoolteachers. In fact, his adoptive parents also were his natural mother's foster parents. Family "stork" Emmy Hopson of Network Engineering (CCN-5) took Fisher to Los Alamos to join his new family when he was just four days old.

His first fishing job was as a deck hand aboard the fishing vessel Miss Olivia. He got seasick the first day, but quickly adjusted. In three months, he made close to $9,000. "The most I ever made in a three-month period as a crewman was $30,000. As a skipper in 1995, I made $42,000," he said.

"A fisherman's life is hard-core," Fisher said, explaining that they work for three to four months out of the year, venture out as far as 100 nautical miles, fish as long as 22 hours a day and bathe maybe once a week while out at sea — many times under incredibly dangerous weather conditions.

"You just train your body to get acclimated to the abrupt lifestyle change. That and three or four pots of coffee a day." He's not kidding. "We also eat like kings when we're out there."

Fisher's alternate career has paid off his undergraduate and graduate school debts. So yes, the money is great, but so is the risk of injury — even death. Commercial fishing in Kodiak consistently ranks every year among the most dangerous jobs in the United States. Sometimes, it's No. 1.

"Last year, 17 fishermen died from Kodiak, some of whom I knew," he said somberly.

Though Fisher has not suffered any fishing injuries, there have been some close calls. "One time, the boat's steering went out, and bad weather was fast approaching. Luckily, another boat was close by and towed us to port," he recalled.

"Another time, a captain who had been fishing for 40 years and never used navigation charts hit a pinnacle at full speed in medium-depth water, ripping a huge hole in the fiberglass hull. By the time we reached a nearby beach, we were in water waist high." The crew managed to temporarily patch the hole and limp back to port.

Then there's this year's close call. Fisher was manning the skiff, a small boat used to spread and secure the fishing net away from the main boat. During a horrendous storm, three huge waves hit the main boat, filling one of the fish holds and completely submerging the stern in water. The captain began to put the boat into full throttle to try to get into calmer waters. However, the skiff — with Fisher in it — was still tied to the boat by a line.

"I was screaming at the top of my lungs trying to get the captain's attention," he recalled. "If he hadn't heard me, the skiff would have flipped over." Luckily, the captain did hear Fisher's yells, and the skiff was released so he could follow the main boat out of the storm.

This latest close call, coupled with his recent marriage and birth of his first child, has made Fisher consider retiring from commercial fishing. If he indeed should retire, however, he has no intention of staying away from Kodiak.

"Maybe I'll go next year as a tourist or take people on tours of the region," Fisher said.

**Reflections**
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