

Tiny porphyrin tubes may lead to new nanodevices

Work could result in clean, inexpensive hydrogen fuel and enable a hydrogen-based economy



GLOWING PORPHYRIN NANOTUBES — Sandia researchers John Shelnutt and Zhongchung Wang gaze upon the glow of porphyrin nanotubes caused by nanotubes' intense resonance light scattering activity. (Photo by Chris Burroughs)

By Chris Burroughs

Sunlight splitting water molecules to produce hydrogen by devices too small to be seen in a standard microscope. That's a goal of a research team led by Sandian John Shelnutt (1116) that has captured the interest of chemists

around the world who pursue this "Holy Grail of chemistry" (see "Photo-electrochemical approach to fuel generation . . ." on page 4).

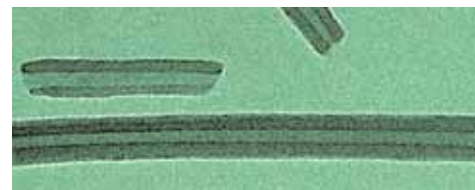
"The broad objective of the research is to design and fabricate new types of nanoscale devices," John says. "This investigation is exciting because it promises to provide fundamental scientific breakthroughs in chemical synthesis, self-assembly, electron and energy transfer processes, and photocatalysis. Controlling these processes is necessary to build nanodevices for efficient water splitting, potentially enabling a solar hydrogen-based economy."

The prospect of using sunlight to split water at the nanoscale grew out of John's research into the development of hollow porphyrin nanotubes (see "Porphyrin nanotubes versus carbon" on page 4). These light-active nanotubes can be engineered to have minute deposits of platinum and other metals and semiconductors on the outside or inside of the tube.

The key to making water-splitting nanodevices is the discovery by Zhongchung Wang (1116) of nanotubes composed entirely of porphyrins. Wang is a postdoctoral fellow at the University of Georgia working in John's Sandia research group. The porphyrin nanotubes are micrometers in length and have diameters in the range of 50-70 nm with approximately 20-nm-thick walls. They are prepared by ionic self-assembly of two oppositely charged porphyrins — molecules that are closely related to chlorophyll, the active parts of photosynthetic proteins.

These hollow structures are one member of a new class of nanostructures made of porphyrins that John and his team are developing. The porphyrin building blocks (tectons) can be altered to control their structural and functional properties.

(Continued on page 4)



AN ELECTRON MICROSCOPE image of a porphyrin nanotube.

LDRD calls for creative ideas from Sandia researchers

By Neal Singer

It's too late to hunt deer and too early to hunt turkey, so now is the right time for imaginative researchers to target a Laboratory Directed Research and Development proposal to help move their best ideas forward.

The FY06 LDRD "call for ideas" went out this week on Sandia's internal web and ends March 30. The process begins with a 250-word abstract — the equivalent of a so-called 'elevator speech' — that concisely describes the proposed research idea and its potential benefit to Sandia. Candidates who pass this first hurdle will be asked to submit a more detailed application. Final funding decisions for FY06 will be made by late June.

The purpose of the LDRD program is to maintain the technical and scientific vitality of the Laboratories. Through use of a peer-review process to select projects, the flexible program is able to anticipate and respond to emerging national needs.

"Sandia's work on chemlab-on-a-chip was achieved well before 9/11," says LDRD program manager Hank Westrich (1011). That highly successful LDRD project developed new technology platforms that rapidly identify harmful chemicals from minute quantities of gas or liquid. "Staff anticipated the need, wrote an LDRD proposal, and developed the S&T that is employed today," says Hank.

While opinions differ among researchers as to how creative or risky a proposal LDRD will accept, there is no argument that some of the most successful projects ever conceived at Sandia got their start from LDRD. Some of the larger and more visible success stories include the MicroChemLab on (Continued on page 5)

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Taking the terror out of terror: Labs' ACG team rethinks physical security for homeland defense

Analysis may lead to less anxiety, more safety

By Neal Singer

Anticipating attacks from terrorists, and hardening potential targets against them, is a wearying and expensive business that could be made simpler through a broader view of the opponents' origins, fears, and ultimate objectives. This is the view of Sandia's Advanced Concepts Group (16000).

"Right now, there are way too many targets considered and way too many ways to attack them," says ACG's Curtis Johnson. "Any thinking person can spin up enemies, threats, and locations it takes billions [of dollars] to fix."

That sad reality is actually part of the war plan of our opponents, says ACG VP and Principal Scientist Gerry Yonas. Gerry reports that an Al Qaeda strategy document signed by Shiekh Naji, dated September 2004, reads, "Force the enemy to guard every building, train station, and street in order to plant fear in their hearts and convince Muslims to join and die as martyrs instead of dying as infidels."

Osama bin Laden put it in this not-so-charming way, according to Gerry: "We are continuing . . . to make America bleed profusely to the point of bankruptcy, Allah willing, and that is not too difficult for Allah" (Nov. 2004).

The ACG — a technical 'think tank' that influences the direction of long-term research at Sandia — is in the early stages of developing a conceptual program to improve America's defenses against terrorism.

"Something to keep in mind," says Curtis, "is that an attack isn't a goal in itself but a means to a further end. It is possible to accept the risk that the terrorist might succeed at some tactical objective — blowing up X — and still foil the terrorist in achieving his strategic goals — scaring the hell out of the American people, stopping air traffic, and so on."

"Since their goal is to terrorize us, one point is to take the terror out of terror," says John Whitley, another ACG group member. (Continued on page 4)



Ken Miller

Barrier to understanding

North to Alaska: ARM-UAV climate programs study arctic cloud physics **3**

Physics giant Hans Bethe remembered by Paul Robinson as friend, mentor **5**



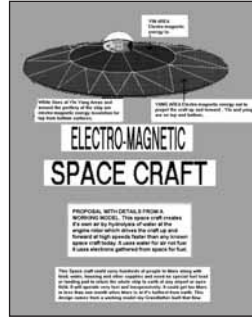
7 Women's Wall of Fame honors 20 Sandians in third year of program

9 Mystery solved! Hope diamond researchers shed light on origins

What's what

You just never know what wonders will materialize when you type that password and your computer screen blinks on every morning. For External Webmaster Janet Carpenter (12651), the days are a little like a paraphrase of George Orwell: Days at work are interesting for all Sandians, but for some Sandians, they're more interesting than for others.

A recent e-mail, for example: "I am sending a proposal DIAGRAHM of a space craft that has been built as a 18" flying model. The text has proof it flew and any ship built to these specifications will fly very fast. It uses water for creating breathable air and fuel collected as electrets from space. I will send the book and mopre diagrams if you contact me. I would like to work with a research facility to create a working model and then a manned ship. I have some of the needed materials available and devices to get started but need a proper lab space insofar as I have flammable rugs in my home."



Along with the message came a drawing with explanations for the separation of the Yin and Yang areas of the electro-magnetic propulsion system and a note that it "could carry hundreds of people to Mars along with food, water, housing and other supplies and need no special fuel load or landing pad. . . . It could get to Mars in less than one month when Mars is at it's furthest from earth. This design comes from a working model my Grandfather built that flew."

Fascinating! Too bad those flammable rugs are holding everything up.

* * * * *

Car names can be entertaining.

The Ford Aspire, for example, was so small it was barely a car at all, and maybe it lasted only four years because it aspired to be a big car and just couldn't make it.

And the Mazda Protégé. Did it go away because it didn't have a mentor?

* * * * *

Trolling for quotes recently, I pulled up a webpage with stuff Frank Sinatra said. Lots of websites of that sort also offer lists of related things - similar quotes, quotes on the same subject, quotes from others in that person's field, and so on.

Of course, Sinatra was in a class by himself, so drawing any parallels would be iffy. You might understand Bob Dylan being there (some British critics have referred to him as America's poet laureate, you know), and John Lennon, and by stretching your imagination in a different direction, maybe even Jim Morrison.

But Curt Kobain? . . . and Britney Spears?!?!?

One of Ol' Blue Eyes' best-known comments was, "Basically, I'm for anything that gets you through the night - be it prayer, tranquilizers, or a bottle of Jack Daniels." And if he learned he was even remotely linked with Curt Kobain or Britney Spears, he'd probably have a little of all three to get him through that night.

- Howard Kercheval (844-7842, MS 0165, hckerch@sandia.gov)

Employee death

Alex Maish of Mobile Robotics Dept. 15244 died March 11 after a long illness. He was 49 years old.

Alex was a programmer/analyst and had been at Sandia since 1978.

He is survived by his son Benjamin and sister Darby Elleman.



ALEX MAISH

Retiree deaths

- Delia S. Stites (age 87)Dec. 21
- Catherine A. Devarenne (74)Jan. 1
- Elmer E. Cooper (80)Jan. 7
- Theodore Frederiksen (58)Jan. 10
- L. Alton Meador (76)Jan. 17
- W. George Perkins (68)Jan. 18
- Lee Baxter Neeley (79)Jan. 19
- Kenneth R. Fortman (94)Jan. 21
- John J. Michnovicz (81)Jan. 21
- Rudolph S. Stefoin (77)Jan. 21
- Danny D. Drummond (60)Jan. 22
- Edward Paul (81)Jan. 22
- Jerry G. Wallace (86)Feb. 2
- Ambrose M. Watson (97)Feb. 3
- Willard E. Prekker (84)Feb. 6
- Harry V. Fisher (74)Feb. 8
- John E. Healey (93)Feb. 8
- Edward D. G. Clenney (87)Feb. 11
- Elvira Antuna Romero (83)Feb. 14
- Helen T. Watkins (90)Feb. 16
- Claudine H. Sproul (94)Feb. 17
- Anne Felsen (82)Feb. 18
- William E. Price (82)Feb. 19
- Larry D. Gillette (65)Feb. 23
- Andrew J. Landis (85)Feb. 26
- Thomas M. Schultheis (73)Feb. 28

For the record

A sentence in the Feb. 4 *Lab News* news feature about the visit back to Sandia of retired clean room inventor Willis Whitfield contained several mistakes. The sentence (opening the third paragraph in the right-hand column) should have read:

"The Friday morning event, put together by Dan Fleming (1900), came about when retired Sandia VP Dick Claassen reminded VP Pace Vandevender (1000) last year that the 50th anniversary of the invention of the clean room was coming up in six years, or 2010."

* * * * *

The caption published with the California-page photo of the Explosive Destruction System in the March 4 issue was for a photo not used. This is the correct caption: "John Didlake describes the system operation. A mock-up of three 4.2-inch mortars is shown ready for loading into the open vessel (the team demonstrated the capability of dispatching more than one munition at a time in this larger system)."

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LDRD funding

Editor's note: The LDRD story starts on the front page and continues to page 5. This is a box that goes with the story.

LDRD funding is an indirect cost that supports these investment categories:

- Science, technology, and engineering to develop and enhance the basic capabilities for Sandia's mission needs, with particular support to the Labs' nuclear weapons capabilities.
 - Mission technologies for S&T innovations aligned with strategic management unit objectives.
 - Grand Challenges for "bold, high-risk ideas with enormous impact on national security."
 - Corporate investments for University collaborations and high-risk ideas
- (More complete descriptions are available on the LDRD homepage located at ldrd.sandia.gov.)

ARM-UAV program makes it to the arctic for first time

Three weeks of high-altitude climate-change research flights take place over Alaska's North Slope

By Nancy Garcia

A dozen years after it got off the ground, DOE's Atmospheric Radiation Measurement – Unmanned Aerospace Vehicle (ARM-UAV) Program carried out a series of high-altitude research flights in the arctic region for the first time in its history, with three weeks of climate change measurement flights over the North Slope of Alaska in October 2004.

The flights were the subject of talks this month in Daytona Beach, Fla., where ARM scientists gathered to discuss that mission along with a broad range of climate-related measurement campaigns. Another topic of discussion was the upcoming February 2006 ARM-UAV deployment to Darwin, Australia, where the airborne data-gathering instruments will be used in conjunction with ground-based, satellite, and ship-based instruments to collect information about the characteristics of tropical clouds at altitudes up to about 50,000 feet above the tropical Western Pacific.

Second stop of a 'grand tour'

The Alaska flights were the second stop in a "Grand Tour" above ARM climate research sites to answer unsolved issues about the interaction of clouds and solar energy. The improved understanding that will come from these measurements will help improve predictive climate models.

The first series of flights was conducted over



THE LIGHTS OF the Thunderdome are reflected in the outer dome of a hemispherical field-of-view radiometer. This radiometer, extensively modified by Sandia for use in the ARM-UAV payload, measures the incident energy in visible light wavelengths from the entire sky above the aircraft.

Sandia California News



INSTALLING RADIOMETERS on a stabilized platform is John Smith (8227). This keeps the instruments level in spite of small aircraft maneuvers.

north-central Oklahoma in 2002. The third stop in the "Grand Tour" will be in Australia.

The conundrum about clouds is whether they tend to shade and cool the Earth or blanket it, trapping in heat and raising the surface temperature, says Exploratory Systems Technology Dept. 8227 Manager Will Bolton, who is technical director for the program.

To understand their role better, a piloted Proteus aircraft was outfitted with 15 discrete instruments, some mounted on the wings, others carried in a payload pod carried under the aircraft or atop the fuselage. Proteus was built by and is operated by Scaled Composites, in Mojave, Calif. The plane underwent three engineering flights there while the payload was controlled through a low-cost satellite link. Then it was flown up to Alaska, refueling in Seattle, with the payload controlled from up to 2,000 miles away through the satellite link.

From Eielson Air Force Base near Fairbanks, the Proteus flew about 90 minutes to the North

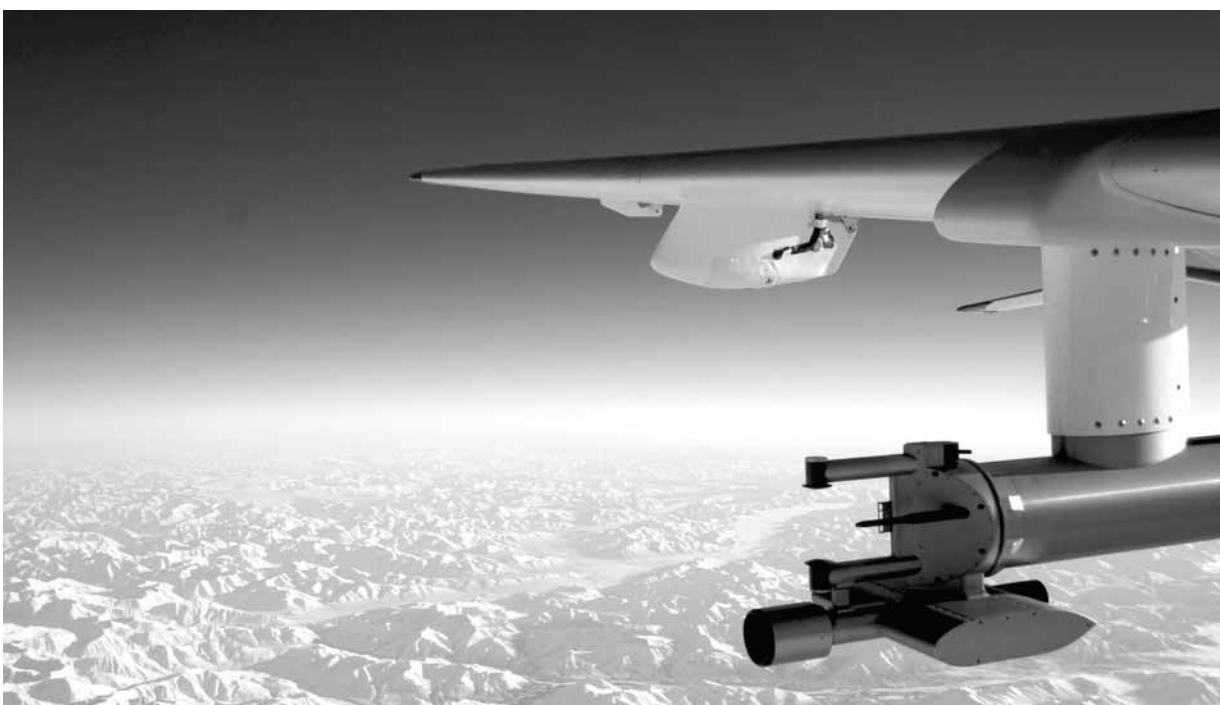
Slope, rendezvousing with a Citation aircraft provided by the University of North Dakota that was stationed at Dead Horse, Alaska. With the Proteus flying up to 13 kilometers in altitude and the Citation flying inside the clouds, the planes collected data in flights lasting from 96 minutes to almost six hours. It will take about six months to process and calibrate the data, which is stored in the ARM archive based at Oak Ridge National Laboratory as a public resource available to scientists and universities.

Helping understand cloud physics

The data gathered by the ARM-UAV Program will help guide the way in which cloud physics is



DURING THE FALL 2004 flight series in Alaska, the Proteus was based in the "Thunderdome" hangar at Eielson AFB near Fairbanks, Alaska. The Thunderdome was built in the 1950s to house the largest US Air Force strategic bomber: the 234-foot-wingspan B-36.



THE CLOUD AEROSOL particle spectrometer, seen here on the Proteus canard over the Brooks Range in Alaska, measures the size and shape of particles, such as ice crystals, inside a cirrus cloud.

embodied in climate models. The models currently differ substantially in how they represent clouds and their effects on the atmosphere.

Whenever possible, the ARM-UAV flights are coordinated with satellite overflights of the ground stations. The coincidence of aircraft-borne and satellite measurements over the ground-based instruments provides a more complete picture of cloud characteristics and offers the advantage of comparing the satellite data with data from more recently calibrated instruments.

Sandia's mission support includes calibrating the instruments, building or modifying some, handling mechanical and engineering design and integration with the aircraft, coordinating field arrangements such as planning and logistics, retrieving and processing data, and directing flight operations at the deployment site.

The latest deployment was supported by some 15 people from universities, laboratories, and industry, including NASA/Ames, the University of Illinois, Colorado State University, the University of Wisconsin, and the University of Massachusetts. This work was supported by DOE's Office of Science, Climate Change Research Division. For more information about the program, see <http://armuav.ca.sandia.gov/armuav1.html>.

Porphyrin tubes

(Continued from page 1)

John says these porphyrin nanotubes have “interesting electronic and optical properties such as an intense resonance light scattering ability and photocatalytic activity.” When exposed to light, some porphyrin nanotubes can photocatalytically grow metal structures onto tube surfaces to create a functional nanodevice. For example, when the nanotubes are put into a solution with gold or platinum ions and exposed to sunlight, their photocatalytic activity causes the reduction of the ions to the metal. Using this method the researchers have deposited platinum outside the nanotube and grown a nanowire of gold inside the tube.

The nanotube with the gold inside and platinum outside is the heart of a nanodevice that may split water into oxygen and hydrogen. The research team has already demonstrated that the nanotubes with platinum particles on the surface can produce hydrogen when illuminated with light. To complete the nanodevice that splits water, a nanoparticle of an inorganic photocatalyst that produces oxygen must be attached to the gold contact ball that naturally forms at the end of the tube. The gold nanowire and ball serve as a conductor of electrons between the oxygen- and hydrogen-producing components of the nano-

device. The gold conductor also keeps the oxygen and hydrogen parts separate to prevent damage during operation.

“Laboratory-scale devices of this type have already been built by others,” John says. “All we are doing is reducing the size of the device to reap the benefits of the nanoscale architecture.”

John says the nanodevice could efficiently use the entire visible and ultraviolet parts of the solar spectrum absorbed by the tubes to produce hydrogen, one of the “Holy Grails of chemistry.”

These nanotube devices could be suspended in a solution and used for photocatalytic solar hydrogen production.

“Once we have functional nanodevices that operate with reasonable efficiency in solution, we will turn our attention to the development of nanodevice-based solar light-harvesting cells and the systems integration issues involved in their production,” John says. “There are many possible routes to the construction of functional solar cells based on the porphyrin nanodevices. For example, we may fabricate nanodevices in

arrays on transparent surfaces, perhaps on a masked free-standing film. However, we have a lot of issues to resolve before we get to that point.”

Water-splitting is just one of the possible applications of the nanodevices based on porphyrin nanostructures. John expects the tubes to have uses as conductors, semiconductors, and photoconductors, and to have other properties that permit them to be used in electronic and photonic devices and as chemical sensors.

Porphyrin nanotubes versus carbon

Porphyrins are light-absorbing molecules related to chlorophyll, the active part of photosynthetic proteins and light-harvesting nanostructures (chlorosomal rods). They are the active molecules in many other proteins such as hemoglobin, which gets its intense red color from a porphyrin.

Porphyrin nanotubes are made entirely of oppositely charged porphyrin molecules that self-assemble in water at room temperature. The more well-known carbon nanotubes are formed at high temperatures and have covalent bonds between carbon atoms.

Porphyrin nanotubes lack the high mechanical strength of the carbon tubes but possess a wider range of optical and electronic properties that can be exploited in making nanodevices. In fact, carbon nanotubes are often modified by attaching porphyrins to increase their utility. This is unnecessary for the porphyrin nanotubes, which can be tailored to specific purposes like water-splitting by varying the type of porphyrin incorporated into the nanotube itself to obtain the desired properties.

Other porphyrin nanostructures such as nanofibers and rectangular cross-section nanotubes have been made and can also be used in the fabrication of nanodevices.

Photoelectrochemical approach to fuel generation is described as one of the ‘Holy Grails of chemistry’

Using nanoscale devices for splitting water is only one of the technological advancements that might make economical and nonpolluting hydrogen production a reality. Other issues of hydrogen storage, delivery, and end-use also must be resolved for a hydrogen-based economy to become a reality.

Technologies for the efficient production of clean-burning hydrogen are a key component of any strategy aimed at reducing US

dependence on imported fossil fuels and reducing carbon emissions. Generation of hydrogen fuel by direct splitting of water using solar energy offers great potential for reducing fossil fuel use while minimizing the environmental impact of hydrogen production.

The photoelectrochemical approach to fuel generation presents formidable technical difficulties and has been described as one of the “Holy Grails of chemistry.”

Team members

John Shelnett (1116), Zhongchung Wang (1116), Craig Medforth (1116), Kevin Zavadil (1832), Frank van Swol (1843), and James Miller (1843).

ACG team

(Continued from page 1)

sider fire: At one time, fire was a major threat to cities and even burned a number of them down. Now we have fire engines, water hydrants, fire insurance — we live with the deadly danger almost without thinking about it. We need to set up the same kind of standby mechanisms against terrorism, and do so in an affordable manner.”

“Suppose every PDA had a sensor on it,” suggests Laura McNamara. “We would achieve decentralized surveillance.” These sensors could report by radio frequency to a central computer any signal from contraband biological, chemical, or nuclear material.

People in airports voluntarily might carry ‘smart’ cards with the same capabilities if the cards could be sweetened to perform additional tasks like helping the bearer get through security, or to the right gate at the right time.

Mall shoppers might be handed a sensing card that also would help locate that special sale or find the closest parking space.

Danger signals would call forth already-in-place defensive procedures.

“The goal here is to abolish anonymity, the terrorist’s friend,” says Peter Chew (9516). “We’re not talking about abolishing privacy — that’s another issue. We’re only considering the effect of setting up an electronic situation where all the people in a mall, subway, or airport ‘know’ each other — via, say, Bluetooth — as they would have, personally, in a small town. This would help malls and communities become bad targets.”

Other ways to fight terrorism start earlier.

“The goal here is to abolish anonymity, the terrorist’s friend. We’re not talking about abolishing privacy — that’s another issue.”

“The game really starts when the bad guys are getting together to plan something, not when they show up at your door,” says Curtis. “Can you ping them to get them to reveal their hand, or get them to turn against themselves?”

Better yet is to bring the battle to the countries from which terrorists spring, and beat insurgencies before they have a foothold.

“We need to help win over the as-yet-undecided populace to the view it is their government that is legitimate and not the insurgents,” says David Kitterman. Data from Middle East polls suggest that most respondents are favorable to Western values; what they dislike, Dave says, are actions they view as unilateral and culturally insensitive. They apparently do not care for threatening rhetoric about pre-emptive military strikes, he says.

There are other ways to win a nation’s people and media over, says Gerry, and that could be through global initiatives that deal with local problems such as the need for clean water and affordable energy.

Says David, “US security already is integrated with global security. We’re always helping victims of disaster like tsunami victims, or victims of oppressive governments. Perhaps our ideas on national security should be redefined to

reflect the needs of these people.”

This part of the process may have already begun. Peter Davies (6100), in a phone interview from Washington, D.C., says, “We have just completed a workshop series in partnership with the Center for Strategic and International Studies on Global Water Futures (www.csis.org/gsi/water.htm). This project is focused on innovation in US international water policy and in the way it deploys technology. The issue of global water is also seeing active attention on the Hill, most recently in a bill titled Safe Water: Currency for Peace Act of 2005. This bill was introduced by Senate Majority Leader Bill Frist last week.”

Peter is director of Sandia’s Geosciences and Environment group.

More technical actions under consideration are to enter chat rooms with company commanders to provide feedback to problems encountered in the field; apply system solutions to monitoring borders without interrupting legitimate traffic flow; and direct more simulated attacks by ‘red’ teams to probe and correct technical weaknesses in US defenses before actual assailants strike.

Gerry believes this global war does not have to last for generations “if we harness the comprehensive capacity of our nation.” He means by this, he says, that while technology will play an important role in the overall struggle, it will be most effective when coupled into the entire range of social, political, psychological, economic, historical, and philosophical issues.

ACG ideas are pursued through fests, workshops, and almost-weekly brainstorm sessions to stimulate innovative approaches throughout the Sandia community.

Paul Robinson remembers Hans Bethe as a friend and mentor and 'the man who invented the sun'

By Ken Frazier

He was one of the last of the giants of 20th-century physics. He won the Nobel Prize for explaining that nuclear fusion powers the sun and stars. He helped make the Manhattan Project a success. And he then returned to a phenomenally productive six-decade scientific career at Cornell University that continued far into his 90s.

But to Sandia President and Labs Director Paul Robinson, physicist Hans Bethe, who died last week (March 6) at the age of 98, was also a personal friend and mentor who Paul remembers with enormous respect and fondness.

"I've known some great people in history," Paul says, "and I've got to say I rank him at the very top. He was not only smart but very wise.

"He certainly does belong up there with the greatest contributors to the success of the Manhattan Project." Bethe headed the atom-bomb project's theoretical physics division.

After the Manhattan Project brought World War II to an end, Bethe returned to university research (at Cornell's Newman Laboratory of Nuclear Studies), but he continued to be a consultant to Los Alamos. Bethe would come out to Los Alamos every six months for a week or so. In the 1970s Paul was a division leader of LANL's applied photochemistry division doing laser-induced chemistry and isotope separation. Bethe would come around to check out his work.

"So he was a guy to evaluate what we were doing but also was a big help in giving guidance and talking about the future and what we were to do next.

"I've worked with a lot of theoretical analysts as well as experimentalists in the laboratory," says Paul. "Bethe was just a superb combination of theorist and experimentalist. He was an experimentalist's theorist."

One of the Bethe stories Paul recalls involves "a trait I have never seen in another human being." Paul's group would conduct briefings on the then new field of laser spectroscopy. "These would be fairly intensive and awfully high-tech briefings. We were blazing some new ground. You could take this exquisite spectroscopy and assign what all the lines were and then assign quantum numbers and isotopes to everything going on. It was an important technical field at the time, with lots of new publications."



HANS BETHE (left) and Boyce McDaniel bicycling around the Wilson Synchrotron at Cornell University in 1968. Bethe died last week at the age of 98.

Even though Bethe would be away half a year, he had an uncanny knack for coming back into such heavy briefings and picking up where he'd left off.

Recalls Paul: "One of the guys remarked, 'You know, I just can't believe it. When we started today it had fully been six months since he was here. But it was just like we had been taking only a coffee break from that last briefing. When we started my briefing, he said, 'Now if I remember right, we had gotten up to this last point and discovered this. . . .'"

"The guy just couldn't believe it," says Paul. "He [Bethe] had an uncanny memory . . . and an appreciation of what were the critical points. I've never seen that trait in anybody even close to his."

Paul says Bethe normally came to LANL without his wife. "So we'd look after entertaining him while he was in Los Alamos, which is not the entertainment capital of the world. Usually we would hold one or two dinner parties while he was in town and invite some of my co-workers. It was always a treat to be able to spend time with Dr. Bethe.

"My son Colin, who was probably 7 or 8 at the time, asked, 'Dad, why is it that everybody treats Dr. Bethe so special?' I thought about it for a minute and said, 'He is special. He is the man who invented

the sun.'

"And we all laughed about that forever, because you know how close to the truth that is. He won his Nobel Prize [in 1967] for his proposal and calculation [in 1938] that showed the stars and our sun are powered by nuclear fusion."

Paul says when he took over the nuclear weapons program at LANL, "He [Bethe] was actually proud of that even though he described himself as a dove, but a tough dove. He was very proud.

"He started being a pen pal to me on various issues. And it continued. I got a congratulatory note when I became ambassador, then when I came to Sandia from time to time every few years I'd get a note. The last one was about a year ago. He was still doing physics — trying to understand supernovas.

"Of the people you'd just consider a treat to know in your life I would put him right up there at the top. He was as unpretentious a man as there could be. He epitomized the phrase unpretentious.

"He was very wise about other things. He was the one who told me, when I lamented that neither of my kids was going to pursue careers in science, he said, 'No, that's because you are too successful in science. You look everywhere, you'll find that people who have a very successful parent will have to blaze another trail to have some independence and freedom. My jaw dropped."

Paul says the last time he saw Bethe for any length of time was in the early 1990s when Paul had Sandia's tech transfer portfolio as VP of what was then Sandia's Division 4000. Cornell University, which Paul says was big in understanding both entrepreneurship and how you move technology forward, "held a symposium to honor Dr. Bethe."

"So I gave a talk. I built it around the idea that the greatest transfer of technology in the history of the world was the Manhattan Project. When the US entered the pre-war years, it was definitely a scientific outback. But because of Hitler and his running all the scientists away from Europe, Bethe high among them, but hundreds of others as well, we vaulted to the number one spot in the world in science and achieved success in the Manhattan Project, the first atomic bomb.

"I want you to know, Hans gave me just the greatest giant smile, and he came up later and thanked me for that perception."

Concludes Paul: "What a terrific guy he was. I truly loved that man."

LDRD call

(Continued from page 1)

a Chip and Solid State Lighting (SSL) Grand Challenge projects.

Says manager Jerry Simmons (1120), who shepherded the SSL proposal and several follow-ups through LDRD, "Congressional funding was down after 9/11 for programs that had previously gained approval, including solid-state lighting. The LDRD program enabled us to develop several LED innovations that were deemed worthy for follow-on work."

The one-page electronic application must be

LDRD 'a well-developed, effective system'

"SNL has continued to demonstrate a well-developed and effective management system for the peer selection process that is screened for relevance to the National Security mission. Technologies presented at this year's program review demonstrated that SNL is conducting cutting edge research and development. I commend them for their ongoing collaborative efforts with other national laboratories, universities, and both foreign and domestic entities . . . The LDRD program remains an integral component to NNSA programs. . . ."

— Ev Beckner, deputy administrator for defense programs, NNSA

New Webtool will assist people with LDRD questions

The LDRD office has leveraged technology developed in the Augmented Cognition LDRD Grand Challenge project to produce a software tool to help technical staff determine in what investment and thrust areas to submit an idea for an LDRD. CallView will be available to all lab employees through the LDRD website (www.lldr.sandia.gov). This software tool allows technical staff to copy and paste their ideas, and then compares it to all LDRD calls using a conceptual similarity evaluation of the idea to all thrust area call documents. The tool then returns a

top five prioritized list of thrust areas that the staff member should consider for submission. Hank Westrich, LDRD manager, states, "CallView will allow staff to identify those investment areas most appropriate for their R&D ideas, as well as other potential Investment Area submission opportunities."

The development team for CallView includes Nabeel Rahal (5925), Travis Bauer (15241), Andrew Wilson (9227), and support from Kevin Boyack (9212), Bryan Wylie (9227), and Keith Ortiz and John Brewer from the LDRD Office (1011).

a convincing description to the Investment Area Teams (IAT) who decide which ideas are to be submitted as full proposals. The IATs are defined by Mission Council, and are made up of technical and programmatic experts from across the Labs. They make the investment decisions for the entire LDRD Program (\$112 million in FY05).

Last year, the LDRD office received more than 1,000 ideas, generating more than 400 management requests for more detailed, six-page proposals. From these, more than 100 new projects were selected for funding. Existing projects are reviewed annually and may be funded for up to 36 months. Currently, there are about 350 LDRD projects that range in size from about \$25K to over \$3M.

LDRD benefits to Sandia beyond DOE mission support are multiple, says Hank. "It attracts new employees to the Labs and enables staff to work at the forefront of science and technology. LDRD enables the labs to be anticipatory and

responsive to the needs of the nation, preventing technical surprises and creating new strengths."

Pressure always exists to modify the program to achieve less imaginative, easier targets so that success is immediately demonstrable. "It's important," says Jerry, "that LDRD retain its focus in investing in innovative new projects and not be tied to short-term program objectives. LDRD provides the seed corn for the corporation; if we eat it now, we'll go hungry later."

The LDRD office staff, which includes Cynthia Harvey-McDonald, Donna Chavez, John Brewer, Keith Ortiz, Danielle Montoya, and Gloria Padilla-Gallegos (all 1011), ensures the smooth operation of the program. Says Hank, "Any of us are available to answer questions about the LDRD call."

Sandia and the LDRD Program are looking for seed corn to nurture. Why not send in your proposal idea?

More on LDRD on page 2

When Dale Preece gets an international award (and he just did), it's an explosive matter

By Michael Padilla

Known as the explosives engineering expert in the field of modeling large-scale blasting for the mining industry, Dale Preece (15322) was recently recognized by the International Society of Explosives Engineers with the "President's Award" for his contributions to the society.

This award also exemplifies Dale's commitment to Sandia's mission, says Robert Tachau (15322), manager of Explosives Applications Dept.

"I'm proud to have Dale as a member of the Explosives Applications Department," Rob says. "This prestigious award is an affirmation of Dale's sustained and exceptional contributions to the explosives engineering body-of-knowledge. It's a joy to work with someone who is so well-versed in all aspects of the art and science of explosives engineering."

Dale, a distinguished member of the technical staff, leads research and development on the design and characterization of conical shaped charges, explosive gadgets, and armor systems.

"A very interesting, fun, and challenging part of my job is the cycle of study, design, build, test, and evaluate that accompanies many of our explosives projects," he says. "As in many other areas of research at Sandia, when we first develop a project we start by thinking about the underlying physics to develop as much understanding as possible."

Then the analysis and characterization of the aspects of the project begins, including treating the problem with analytical methods followed by application of several different computer codes.

He says carrying out the cycles to develop explosive gadgets and hardware is very much a group effort with contributions from everyone in the department.

All methods are iterated until a design is developed which is either built by the department or contracted out.

"When the hardware is complete we test it at the Explosives Applications Laboratory and use diagnostics to determine if the hardware is performing as designed," he says. "An evaluation is then



EXPLOSIVE EXPERTISE — Dale Preece (15322) with barrels from a 6-barrel, 6,000-round-per-minute Vulcan cannon that were burst at the Explosives Applications Laboratory using explosive bullets placed in the barrel. This same kind of bullet went off prematurely a number of times in the barrels of guns aboard FA-18 fighter aircraft during flight. Sandia played a key role in solving this problem as well as determining a safe reapplication for \$100 million worth of this ammunition. (Photo by Bill Doty)

done to determine the sufficiency of the design and if the cycle requires another iteration."

He likes all aspects of the cycle and enjoys having one foot rooted in the reality seen in the lab and one foot in the analytical and computer-simulation world.

Most recently, Dale oversaw research led by Vanessa Berg (15322) on computer analysis and laboratory testing on the Sandia Gauntlets (*Lab News*, Feb. 18). The controlled test series characterized the ballistic limit of the gauntlets against different-sized fragment masses.

"The body and vehicle armor development we

are doing, including the Sandia Gauntlet, will save the lives and limbs of soldiers fighting the war on terrorism," says Dale. "Direct support of DoD programs is an important part of Sandia's mission."

Along with Jerry Stoffeth and other 15322 personnel, Dale has designed and guided the manufacturing of various conical shaped charges. These conical shaped charge designs, by the Explosives Applications Dept., have been done for the Explosives Destruction System (EDS) being developed by the DoD for disposal of chemical munitions (*Lab News*, March 4, and below).

The department also frequently participates in studies that involve prediction of explosive/structure interaction for explosives vulnerability analyses. These studies have been performed for the military (related to force protection), the DOE, DHS, and other customers.

In the spring of 2002, Dale was contacted by US Army field operators in Afghanistan for technical advice on destroying tunnels and caves. Dale provided the necessary information for optimum placement of explosive charges. Through an exchange of e-mail and sketches, he was able to assist the Army in successfully destroying various tunnels. Dale received a Sandia Employee Recognition Award (ERA) in 2003 for this work.

Dale has led numerous rock-blasting projects, including developing computer code that simulates effects of rock blast and blast designs. He assisted with a project near Grants, N.M., to determine ways to remove rock from coal layers. The goal was to achieve a more efficient method to move rock with explosives instead of using mechanical equipment. The computer code generated from this project was transferred to industry.

Since his Sandia start date in 1980, Dale has mentored 11 graduate and postdoc students, authored more than 100 technical publications on a broad range of explosive engineering topics, and has received numerous awards and recognitions.

Dale emphasizes the strong group effort in Dept. 15322. "I wouldn't amount to much without an outstanding team of individuals around me," he says.

External web gets new look



A new-look Sandia External Website was launched Monday (at www.sandia.gov) to emphasize Sandia's national security missions and supporting technologies. The new design also makes it easier to find certain types of information of particular interest to Sandia partners, customers, suppliers, retirees, employment candidates, visitors, and news media.

The new home page also includes a featured Sandia site that will emphasize technical projects. First up is the Sandia Water Initiative, which among other topics discusses water safety, security, and sustainability issues and links to detailed project and other related information.

Three current Sandia news releases will continue to be linked from the home page along with Sandia general information (the "About" page), the Advanced Concepts R&D page, the employee locator, and more.

The redesign was a collaborative effort involving Sandia's Information Systems Development Center and Public Relations and Communications Center.

Labs demos Explosive Destruction System



GILBERT GONZALEZ (15322, right) explains to Larry Gottschalk, project manager for the US Army Non-Stockpile Chemical Materiel Project, the process of destroying munitions at Sandia's Site 9930 explosive test chamber. The chamber is used to verify the design of the munition opening and destruction systems prior to operational testing in the vessel of the portable Explosive Destruction System (EDS). The briefing was part of an overview Gottschalk received last week about the EDS at Sandia's Explosives Applications Department in Albuquerque. The EDS had recently come to Sandia/New Mexico from Sandia/California (*Lab News*, March 4). In the inset photo, Dave Cole

(15322, left) shows Gottschalk a mock munition destroyed in the EDS. Gottschalk says the system will be used to destroy recovered chemical warfare materiel stored at Pine Bluff Arsenal, located in southeast Arkansas. The materiel will be destroyed in accordance with the Chemical Weapons Convention Treaty (CWC). Gottschalk says he is impressed with advances in the EDS, which will increase the systems throughput rates, and shorten the operations schedule for destroying the materiel at Pine Bluff. The Army approached Sandia 10 years ago seeking an approach to destroy aging unstable munitions. The simulated demonstration used munitions containing water. (Photos by Bill Doty)

Women's Wall of Fame in Bldg. 802 honors 20 Sandians for third year in a row with special six-poster display

For the third year in a row 20 Sandia women are being honored in the Women's Wall of Fame.

The "wall," a series of six posters highlighting achievements of some of Sandia's outstanding women, was unveiled to the Labs Leadership Team (LLT) on Monday with Sandia President C. Paul Robinson providing comments. It will be celebrated at a ceremony at Sandia/California on Thursday where Jill Hruby, director of Physical and Engineering Sciences Center 8700, will make remarks. The wall will first reside in Bldg. 802's glass cases on the first floor and later be loaned out for special events such as Family Day.

This is the third year the Sandia Women's Action Network (SWAN) is recognizing the accomplishments of Sandia women with the wall.

"We wanted a way to highlight awards the women have already received and raise awareness of significant ways women at Sandia are contributing to our community," says Judy Moore (16000), who together with Georgianne Smith (3000) co-chairs SWAN.

March was selected as the month to honor Sandia's women because it is Women's History month.

Georgianne says one of the six posters is an organizational chart showing all the female directors and vice presidents at Sandia.

"There are so many employees who do great work at Sandia and in the community, and we are proud to be able to highlight some of them," Georgianne says.

The titles of the other posters include Making Key Contributions, Earning Recognition, In the News, Community, and Nontraditional Path.

A committee selected the women based on nominations and by studying publications like the *Lab News* that include stories about accomplishments of Sandians in general.

The posters have won awards for the past two years in the Society for Technical Communications competitions.

Here, on this page and the next, are the 2005 honorees in their categories.



Story by Chris Burroughs
Posters designed by Jan Gaunce
and Steve Pope

WOMEN at SANDIA NATIONAL LABORATORIES
Here, There, Everywhere... Making Key Contributions

JJ Rambo
Laboratory Staff
Procurement Line Support 10240

Rhonda Dukes
Laboratory Staff
EMOC and MESA Procurement 10241

Rita Baca
Administrative Staff Associate
Corp and Strategic Purchasing 10223

- Rita Baca discovered flaws with the invoice process for consultant agreements, specifically when there was inadequate funding. Rita proposed a new invoice process for consultant agreements to significantly reduce work loads.
- JJ Rambo worked with service contractors through a myriad of problems to complete Sandia's Environmental Restoration Program projects on schedule and under budget.
- Rhonda Dukes partnered with the DOE which allowed for a 12-week schedule reduction on construction procurements. She has worked extensively with the New Mexico small and minority business community to increase participation on the MESA Project.

Diana Helgesen
Technologist
Kauai Test Facility & Remote Ranges 15149

- Photo assignments have taken her from ice in the Arctic, to inside a burning battleship off the harbor of Mobile, Alabama.
- Photographed rocket launches in Alaska, Kauai, and Vandenberg.
- Winner of numerous awards on launch images which have been used in many publications, including *Aviation Week*.
- Represented Sandia with launch photos which are on display throughout the United States and in the Pentagon.

Judith McKinney
Manager
New Performance Innovation 9725

- Led development and deployment of Milestone Reporting Tool deployed to all nuclear weapon complex sites.
- Successful cycle of 4 consecutive Quarterly Program Reviews.
- Provides structured approach to program management, transparency around performance, and integrated look at work scope.

Liz Schexnayder
Technical Staff
Firing Set, Fuze & Switch Tube 2616

- Lean Six Sigma Green Belt Certificate
- Helped coach Kaizens event improving quality and cycle time of MC4712 Impact Fuze Mass Property Measurement Process at Kansas City Plant
- HMTech Robotics Instructor
- Component Engineer for components in the W76-0, W78, W88, B61 and B83
- Designed Vertical Impactor Assembly to impact W76-0 Impact Fuze during fratricide test

Did you know?
SWAN's Mission includes:

- Creating a powerful network to support and develop careers of all women at Sandia.
- Recruiting strong, capable women at organizational levels.
- Promoting outreach/inreach, encouraging women and girls to pursue careers in engineering, science, math and other technical fields.

Sandia National Laboratories

Making Key Contributions

(Note: JJ Rambo, Rhonda Dukes, and Rita Baca were Sandia 2004 Buyers of the Year.)

- JJ Rambo** (10251), Laboratory Staff, worked with service contractors through a myriad of problems to complete Sandia's Environmental Restoration Program projects on schedule and under budget.

- Rhonda Dukes** (10253), Laboratory Staff, partnered with DOE, which allowed for a 12-week schedule reduction on construction procurements, and has worked extensively with the New Mexico small and minority business community to increase participation on the MESA project.

- Rita Baca** (10256), Administrative Staff Associate, initiated a new invoice process for consultant agreements, significantly reducing work loads.

- Diana Helgesen** (15419), technologist. Her photo assignments have taken her to working on the ice in the Arctic and to photographing inside a burning battleship off the harbor of Mobile, Ala. She photographed rocket launches in Alaska, Kauai, and Vandenberg. She has won numerous awards for launch images that have been used in many publications, including *Aviation Week*. Diana's launch photos are on display throughout the US, including in the Pentagon.

- Liz Schexnayder** (2616), Technical Staff. She attained a Lean Six Sigma Green Belt certificate by co-coaching a kaizen event for improving quality and cycle time of the W76-1 MC4712 Impact Fuze Mass Property Measurements process at the Kansas City Plant. She has responsibility for numerous electromechanical components in the W76-0, W78, W88, B61, and B83 weapon systems and is an HMTech robotics instructor in the summer. One of Liz's greatest accomplishments was design of a Vertical Impactor Assembly (VIA) to function the W76-0 MC2984 Impact Fuze during fratricide test.

- Judith McKinney** (9725), Management. Judy managed a team that developed and deployed the Milestone Reporting Tool used by all nuclear weapon complex sites. She organized the successful cycle of four consecutive Quarterly Program Reviews. The MRT provides a structured approach to program management, transparency around performance, and an integrated look at the \$7B work scope.

In the News

- Ann Bouchard** (1128), Technical Staff. Ann and co-workers showed certain protein self-assembly processes can act as a novel form of programmable computation, equivalent to a Turing machine. She is a co-developer of self-assembling software technology, modeled after protein self-assembly. She also led multiple software projects to develop vulnerability analysis tools for the DOE complex.

- Bianca Keeler** (1769), Technical Staff. She is a member of a team developing a new class of small hand-held devices using light-wave interference to detect motion 1,000 times more subtly than any known tool. Bianca is the principal investigator of an LDRD research team creating integrated, high-sensitivity inertial sensors from these devices. She was also a 2004 Director of Central Intelligence Postdoctoral Fellow and is a participant in Sandia's mentoring program.

- Rochelle Lari** (3553), Laboratory Staff. She presents "An American Woman in Iran," which depicts her personal journey to meet her Iranian husband's family. The show was presented at LANL, the Veterans Administration Hospital, and other local venues in Albuquerque. She is a leader of Sandia's Diversity Leadership Program and has raised her sons to be proficient in three languages: English, Spanish, and Farsi.

More Women's Wall of Fame honorees on next page ▶



MANOS program plants seeds of science enthusiasm

By Iris Aboytes

Sandia's Manos Science & Engineering Program has just completed its 14th year. It is designed to introduce science, engineering, and math concepts to middle school students.

The program is sponsored by Sandia's Hispanic Leadership Outreach Committee, Diversity, EEO & AA Department, Albuquerque Public Schools, and TVI.

Classes are taught in physics (How does a rocket work and fly?), chemistry (How do they make fireworks in different colors?), electronics (What is electronics/electricity?), computer design (What makes a computer tick and how can you use it?), robotics (Students learn to build and program robots and work with LEGO Mindstorm kits), and fun with math and money (Can you guess how many red M&Ms are in a jar?).

The four-week program met after school on Tuesdays and Thursdays at Rio Grande High School and on Mondays and Wednesdays at West Mesa High School. Students rode the bus from their middle schools to either high school. The program is intended to support the development of a scientific and technically trained student-base with hands-on technology experiences.

Joe Maez (5744) has volunteered in the program since the beginning. He thought he would do it for three or four years. "One day a student's mother came by the MANOS class at Rio Grande High School," says Joe. "She asked me if she could



PAT CHAVEZ (9232) helps student with an Internet scavenger hunt in a MANOS Computer Discovery unit. (Photo by Michael Garcia)

take her son's equipment and project home for him to finish it. Her son was home with a fever and had not attended school that day, but he had begged her to let him come to MANOS to complete his project. She got approval from the doctor for her son to finish the project at home. That's why I do it. I know we [volunteers] make a difference."

"In a four-week program there is plenty of time to plant a seed," says Danny Rey (2565). "All it takes is one seed. The program was designed to target mid-school students because at this age students begin to lose interest in science. This allows

the student to stay interested in science by taking science classes through high school and hopefully continues on to college."

The decision to name the program MANOS was twofold. First, it implies hands-on engineering. "Also when referring to our brothers in Spanish we don't usually refer to them as *hermanos*, the translation of brothers, but a short form — *manos*," says Danny. So back when the program was started, we all felt this was a perfect name. That one word stated and implied everything we wanted to do and say."

Targeted to Hispanics, the program is all-inclusive. No student wanting to learn is ever turned away. The classes are designed to keeping students interested, showing them that science can be fun. The program works to improve students' academic success and self-esteem. The focus is to increase and promote student academic excellence at the precollege level.

"It is a great feeling when a student tells you that he can hardly wait until the next class," says John Romero (12870), coordinator and math instructor. "After they participate in the MANOS program, I am confident that the students' interest and awareness in related classes at school is noticeably increased."

The program is held yearly, roughly February to mid-March. For more information on MANOS, call Brenda Barajas-Romero at 845-9589 or go to the MANOS website at www.sandia.gov/Human_Resources/manos.html.

Women's Wall of Fame

(From preceding page)

Earning Recognition

- **Carol Ashby** (11500), Technical Staff. Carol received a 2004 R&D 100 Award as a co-inventor of the Cantilever Epitaxy and Growth of Low-Dislocation Gallium Nitride. Her first R&D 100 Award came in 1993 when she co-invented the Aqueous Chelating Etch system. She's also the coauthor of a soon-to-be-published book, *Fabrication of GaAs Devices*.

- **Nancy Jackson** (6901), Deputy Director. She was named a Fellow of the American Association for the Advancement of Science for significant contributions to catalysis research, for contributions to science policy, and for championing diversity and inclusiveness in schools.

- **Jacqueline Chen** (8351), Technical Staff. Jacqueline won the single largest award from the DOE Office of Science for 2.5 million cpu hours at the NERSC supercomputing center. With this award she and her postdoctoral fellow, Evatt Hawkes, are studying turbulence-chemistry interactions in three-dimensional combustion simulations of turbulent flames where fuel and oxygen are not premixed — relevant in jet engine and fuel-injected internal combustion engine technologies. She is the co-editor of *Proceedings of the Combustion Institute*, Vols. 29 (2002) and 30 (2004), and a member of the editorial board of *Combustion and Flame*.

- **Dawn Skala** (8753), Technical Staff. Dawn received the NNSA's Defense Program Award of Excellence. She oversees a certification program for high-reliability assemblers. She also creates and manages specific process development agreements with the Kansas City Plant. She is currently working with microsystems.

- **Tamara Kolda** (8962), Technical Staff. Tamara received a Presidential Early Career Award for Scientists and Engineers. She was one of 57 people in the US to receive the 2003 award and is the third Sandian to receive this award since its inception in 1996. She develops new computational algorithms and was part of the R&D 100 award-winning Trilinos team. She brings great energy and creativity in diverse mathematical areas and serves as a mentor of younger researchers.

Nontraditional Path

- **Mitzie Bower** (12654), Laboratory Staff. Mitzie is a graphic design artist at Sandia. At the age of 17 she was in a gymnastics accident that rendered her a quadriplegic, but also led to her passion for visual beauty. She painted a life-sized model of a horse, "Wilderness Roundup," which was on display at Sandia for several weeks. Mitzie also serves as a role model to special-needs children.

- **Marilyn Hawley** (8112), Technical Staff. Marilyn leads Sandia's software development team for the DTRA BioNet Project. Her cross-site, multi-center team (with members in 8100, 8900, and 9500) is developing a simulation application for exploring military and civilian bio-terrorism detection and response architectures and evaluating integrated concepts of operation. Marilyn began her Sandia career as an ASA, became a technologist, earned a bachelor's degree in Computer

Community

- **Malynda Aragon** (10862), Technical Staff. She is a mentor for students in Sandia's STAR program, in Facilities and Engineering departments, and online with the MentorNet program. She is a chemistry instructor in the Sandia MANOS program (see story on MANOS above) at West Mesa High School. She is also a presenter in the New Mexico Scholars Program and president of the local PEO Chapter that provides scholarships for women who would not otherwise have opportunities to obtain college degrees.

- **Linda Gillen** (5925), Technical Staff. She is co-chair of the DHS/FEMA National Urban Search and Rescue Accountability Working Group and a Technical Information Specialist on the New Mexico Urban Search and Rescue team. She is one of very few women in urban search and rescue and volunteered more than 700 hours in 2004.

- **Carol Yarnall** (12100), Management. Carol is the first woman to lead the Wheeling Jesuit University Board of Directors. She is active in the Central New Mexico Chapter of the Society of Women Engineers and is a role model to many women at Sandia. She also leads Sandia's government relations functions.

- **Debora Ley** (6218), Technical Staff. Debora is assigned to the International Sustainable Engineering Group (ISEG). She is part of a team that works mainly in Mexico and Central and South America. The program has provided energy in a sustainable manner for productive use and social applications such as televised education, agriculture, protected-areas management, and electrification. The goal is to increase the quality of life for the various communities. As a student intern, she supported Sandia's Mexico Renewable Energy Program (MREP) and worked with the solar energy group. She got accepted into the OYOC Program and earned her graduate degree at the University of Colorado at Boulder.



Science, and transitioned to the technical ladder.

- **Diane Gomes** (8947), Technologist. She established a security interdisciplinary videoconference design review and led the effort to bring together a number of different security functions. She significantly improved the ability to accurately estimate installation costs for complex classified/unclassified videoconference facilities. Diane came to Sandia as a high school student intern for computing. She was hired and became the first DTNG at the California site.

- **Melissa Martinez** (14221), Student Intern. She was introduced to science through the Sandia MANOS program in mid-school. She attended West Mesa and graduated from Valley High School. She is currently at UNM studying to be a mechanical engineer and aspires to work at Sandia.

Forensic gemology: Stephen Attaway's research hobby casts new light on origins, history of Hope diamond

By Will Keener

For an engineer who makes his living doing vulnerability assessments and crunching numerical simulations of crashes and impacts using massively parallel computing, Stephen Attaway knows surprisingly a lot about the Hope diamond.

In fact, Stephen (9134), along with his wife Nancy and local diamond replica expert Scott Sucher, have recently completed a combination of historic and high-tech research that sheds new light on the life of the stone.

"There is a lot of mystery and intrigue about where the Hope came from," says Stephen. "We closed some gaps in a history that a great many people are interested in. And we were able to create an accurate replica of the Hope and the predecessor stones we think it came from."

So far the gem detective work, done completely as a hobby project at home, has garnered the attention of the Discovery Channel, which premiered a 30-minute documentary on the project last month, and *Lapidary Journal*, a key trade publication, which is in the process of publishing a paper authored by Nancy. Locals interested in cut gems in general and the Hope diamond in particular will have a chance to learn more this weekend at a display and show hosted by the Albuquerque Gem and Mineral Club (see "Gem Show" below right.)

Smithsonian cooperation

Stephen, Nancy, and Scott did their research in cooperation with the Smithsonian Institution's National Museum of Natural History in Washington, D.C. Every year some seven million visitors come to the museum, many of them expressly to see the 45.5-carat Hope diamond. Jeffery Post, Smithsonian curator of gems and minerals, calls the research "exciting." The work represents new information about the museum's collection of 375,000 specimens, he says. "We are constantly learning new things about our collections as we apply new high-tech research methods. Even the Hope diamond is grudgingly giving up some

Collectors, doing the math from 67 to 45 carats, wondered if perhaps there could be a large sister stone to be found after the re-cut.

of its secrets."

The researchers used state-of-the-art imaging and computer modeling technology, new measurements of the Hope, and historical records and



THE HOPE DIAMOND in its setting. (Photo courtesy of Smithsonian National Museum of Natural History)

sketches of two historic diamonds to create accurate virtual models of the three. "We were invited by the Smithsonian to photograph the Hope out of its setting. We even got to hold it in our hands. But we didn't get to hold it very long," says Stephen.

A highlight of the trip was a personal tour through the cut gem collection in the Smithsonian vault. "For Nancy, who has a long interest in gems and is an expert gem cutter, this was a once-in-a-lifetime chance," says Stephen. And the data from the trip proved critical to the result of the project. It supports the theory that the Hope was cut from the French Blue Diamond, stolen from

the French crown jewels in 1792.

A 'sister diamond?'

Many have speculated over the years that a second blue diamond, or "sister diamond," cut from the same "parent stone," could still exist in a collection somewhere in the world. To understand this, you have to follow the history, beginning with the Tavernier Blue, named after a gem merchant who sold King Louis XIV of France a 112-carat blue diamond from India in 1668. A court jeweler cut the famous 67-carat French Blue out of the Tavernier. It became part of an ornate item of jewelry worn by European royalty until 1792, when it was stolen.

From here history slips into mystery, although most believe that the Hope came into being in the early 1800s when it was re-cut at 45.5 carats from the French Blue in London. (Henry Philip Hope was a diamond collector who owned the stone, hence the name.)

Collectors, doing the math from 67 to 45 carats, wondered if perhaps there could be a large sister stone to be found after the re-cut.

Stephen and his colleagues approached the problem with the idea of constructing, as accurately as possible, virtual and real models of the three historic diamonds. They used books from Tavernier's travels in India, historic sketches, articles from a French gemology review, data about the lead molds used in creating Louis XIV's jewelry, and some modern technology. In the case of the French Blue, Stephen generated 14 different iterations of what the diamond might look like based on known data about it, using CAD software, and finally finding a good match of the known dimensions and weights.

Mystery resolved

Using 30 photos of the Hope from their Smithsonian trip, Stephen applied 3-D photo measurement software to generate an accurate rendition. The model showed that the Hope did fit within the French Blue, tightly and only in one way.

Using the software models, Scott cut a model of the Tavernier, and Nancy cut a model of the French Blue, both from dark blue cubic zirconia. These replicas were given to the Smithsonian, where they will eventually be displayed near the Hope diamond. Then, by creating molds of the three diamonds using a lost-wax process, the team demonstrated the unlikelihood of a sister diamond. "We believe the diamond material lost during the re-cutting of the French Blue to the Hope was ground into powder," says Stephen.

Although this is not what the Discovery Channel wanted to hear, the program's originators were able to make an interesting 30-minute segment out of the effort. "They were convinced the other half of the Hope was out there and they were hot on the trail of it," says Stephen. "In fact, we proved the opposite of what they wanted."

A film crew spent three days in Albuquerque, helping to give Stephen, Nancy, and Scott their 15 minutes of fame. "It was an interesting process," says Stephen, "but I learned that I'm not an actor."

Gem show March 18-20

An exhibit featuring the work of Stephen and his research colleagues on the Hope diamond can be seen as part of the "Treasures of the Earth 2005" gem and mineral show at the New Mexico Expo (state fairgrounds) March 18-20 in the School Arts/Flower building. Hours are 10 a.m. to 6 p.m. Friday and Saturday, 10 a.m. to 5 p.m. Sunday. The show features many other exhibits, as well as gem and mineral vendor displays. Cost is \$3 for adults, free for children under 13. (Friday tickets: \$1)

Research: No 'sister stone' for Hope diamond



HOPE ANCESTRY — The three "stones" above are, from left, computer simulations of the Tavernier Blue, French Blue, and Hope diamonds, created by a research team, including Sandia's Steve Attaway. The team also created replica diamonds cut from cubic zirconia, which will be displayed by the Smithsonian Institution with the real Hope diamond. At right, the three perspective views show how the Hope fits within the French Blue and the latter into the Tavernier Blue, resolving the mystery of whether other significant "sister" diamonds may exist.

(Photos courtesy of Steve and Nancy Attaway)

"We believe the diamond material lost during the re-cutting of the French Blue to the Hope was ground into powder."

Gem researcher Stephen Attaway

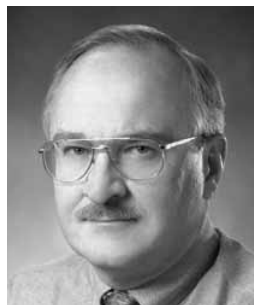


Mileposts

New Mexico photos by Michelle Fleming



John McAuliffe
35 3011



Alan Parker
30 14412



Nick Durand
25 10827

Recent Retirees



Scott Mills
25 6143



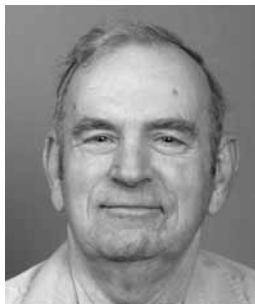
Chuck Kearns
21 10265



Milrene Goodloe
25 9612



Moses Jones
25 14412



Raymond Josephson
25 9615



Mary Montoya
25 10244



Rosemarie Renn
25 2614



Henry Westrich
25 1011



Gloria Zamora
25 12123



Lucy Baca
20 2002



Dorth Carr
20 5533



Dan Carroll
20 5733



Bob Davis
20 9224



Frank Delnick
20 2552



Vincent Luk
20 15431



Joseph Perry
20 2663

Retirees' reporting requirements for sensitive foreign travel eased

This note for retirees comes from Sandia's Foreign Interactions Office (4233-3).

Sandia retirees: You no longer have to report your unofficial (personal) foreign travel to countries on the DOE Sensitive Country List to Sandia's Foreign Travel Office. If you have been rehired as a contractor to Sandia, you will need to report unofficial travel to sensitive countries only if you hold a DOE clearance.

If you have any questions, contact the Foreign Travel Help Line (845-1300) or the Counterintelligence Hotline (284-5923) or e-mail at CI-Help@sandia.gov. The Sandia/California counterintelligence contact would be fjmoore@sandia.gov.

Of course, due diligence should always be used when discussing past employment with people you might meet on your travels.



Don Small
20 2348



Jill Wheeler
20 1851



Nancy Campanozzi
15 1701



Bob Campbell
15 1674

Feedback

Up against the (240-hour) wall

Q: I am constantly up against the 240-hour vacation carryover limit. Is it considered illegal or unethical to charge vacation (10000-241) and flextime for the same hours worked? It amounts to taking vacation while you are at work and then charging your work time to your case as flextime (overtime). This would allow the busy overworked employee to convert vacation hours that they would otherwise lose into flex-time. Thus banking the hours for possible later use or at least until the end of the current FY.

A: There is no question that accuracy and integrity in labor charging is of extreme importance to each and every one of us. As a company, Sandia has pledged to live up to the highest standards of labor charging, just as in any other transaction related to doing business with the government and any other customer. The key principle for all of us to follow is to charge what you work. The scenario you describe in your question would be a violation of the aforementioned key principle — you are working, not on vacation, and to further charge flextime on a regularly scheduled workday (when it would not be time outside your standard daily work schedule) would not exhibit accuracy and integrity in your labor charging. — Don Devoti (10502)



Ellen Cook
15 16000



Steven Grieco
15 1303



Deborah Hansknecht
15 9312



David Leong
15 9329



Roberta Malcomb
15 12830



Mike Mink
15 9618



Whitney Wolf
15 10854



David Yocky
15 5937



BLOW OUT by Craig Nimmo (6329)

Winning photos tell three environmental stories

Pictured here are the three winning photos in this year's Environmental Photo Contest. In addition to the winners, the judges also awarded thirteen honorable mentions. Photos will be used in environmental education outreach activities and in the Annual Site Environmental Report, says organizer Amber Montoya of Environmental Management Dept. 6331. Here briefly are the stories of the winners:

Blowout

When Craig Nimmo, a technologist in the ES&H Customer Support Dept. 6329, and two other Labs safety professionals arrived in Carlsbad to support the Sandia office there in the wake of a natural gas well blowout, they didn't have to ask where the fire was. "It was so loud and so bright you could easily find it," says Craig. He and his colleagues got as close as they could and Craig took the winning photo from a nearby roadway. (The *Lab News* published the photo in its April 2, 2004, front-page news story about the well blowout.)

The blowout was deliberately set afire, explains Craig, to prevent the possibility of a disastrous explosion. In this case the well was capped to vent horizontally. Unfortunately it vented in the direction of Sandia's nearby offices. An advance team, including Craig, entered the offices to ensure it was safe for Carlsbad employees to enter and remove valuable files and equipment.

Kitty

Gary Bailey of the Environmental Restoration Field Office in Dept. 6146, says the bobcat, which he refers to as "kitty," showed up in the office yard one day, dined on several birds at a nearby feeder, and curled up to sleep in a sunbeam behind one of the sheds. Gary and field office colleague Robert Lynch kept an eye on "kitty," get-

ting closer and closer and taking pictures. "Closer and closer and braver and braver," says Gary, who was about 12 feet away when he took the photo shown here. "After three or four hours, kitty ambled off. No chance for an autograph."

Feed me!

The common raven chicks photographed at the Tonopah Test Range in Nevada was a "chance opportunity," says Steve Cox (6331). "I found the nest site while watching the adult ravens flying repeatedly up to an old test observation tower. As ravens are very smart, I am always interested in their behavior and what they might bring to the nest. So, I decided to take a look.

"Usually, ravens have only one or two chicks. I was surprised to see five. I estimated their age to be three to five days. Their eyes are just starting to open, and at this point they really can't see very well. The chicks assumed I was a parent with food and they all wanted to be the first to be fed."

Steve stayed only a minute or so. "The parents were none too happy about me looking in on the chicks. They escorted me for over 200 feet as I walked away and then finally checked their nest to make sure every thing was in order."



FEED ME by Steve Cox (6331)



KITTY by Gary Bailey (6146)

SANDIA/NM
MAY 14 • 2005

SANDIA
2005
Family Day

Sandia Family Day is coming. Show off your place of work to your friends and family members. The much-anticipated event, last held in conjunction with Sandia's 50th birthday party in 1999, is scheduled for May 14 in New Mexico and May 21 in California.

Watch for more information over the next few weeks.

SANDIA/CA • MAY 21 • 2005