



Cyber Engineering Research Lab opens



SEN. TOM UDALL, Rep. Ben Ray Lujan, and other dignitaries helped Sandia celebrate the opening of the Cyber Engineering Research Laboratory. Story, photos on pages 6-7.



A sea change

New patent law impacts publication of scientific research

By Nancy Salem

Parts of the America Invents Act (AIA) of 2011 that take effect on March 16 could profoundly alter how and when scientific research at Sandia is publically disclosed, published, and patented.

On March 16, the AIA switches the US priority right to a patent from the present first-to-invent system to a first-inventor-to-file system. First-inventor-to-file and first-to-invent are legal concepts that define who has the right to be granted a patent for an invention.

"The first-inventor-to-file system is intended to bring the country in line with how the vast majority of industrialized nations handle patents," says Kerry Kampschmidt (11500), Sandia's chief intellectual property counsel.

"This will be a complete culture change for Sandia," he says. "Sandia has a long history of publishing research, and our proclivity to publish and not think about patents until afterward could have a dramatic effect on our ability to patent things in this new environment. We've always known that if we were the first inventor we were the only one entitled to the patent. Nobody else could get it. Well, that



ACTING VP AND CHIEF TECHNOLOGY OFFICER Julia Phillips, who leads Sandia's technology transfer efforts, says, "If researchers are thinking about potential intellectual property at the beginning of their project and begin working with the partnerships organizations as soon as a technical advance is written, there is a much better chance that the IP can be appropriately protected and that commercial partners can be attracted who will license the invention and take it into the marketplace." (Photo by Randy Montoya)

goes away. Now any inventor who is the first to the patent office is the one who gets it. It's a completely different situation."

Conception and reduction to practice

The outgoing first-to-invent system has two principles: conception of the invention and reduction to practice of the invention. When a person conceived of an invention and diligently reduced the invention to practice either by experimenting with or working on the invention until it was in a completed form or by filing a patent application on the invention, the inventor's priority right to the invention was the date of conception. So, under the old system, provided an inventor was diligent in reducing an application to practice and was the first inventor, he or she was entitled to the patent even if another person filed a patent application before the first inventor.

"The concept of conception and reduction to practice generated a lot of extraneous costs," Kerry says.

Under the incoming first-inventor-to-file system, the first inventor to file a patent appli-

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Chelyabinsk meteor heard 'round the world Sandia infrasound sensors detect bolide

By Heather Clark

Darren Hart (5736) was busy reviewing data from the previous night's test of infrasound sensors from a US station that monitors for nuclear detonations at Sandia's Facility for Acceptance, Calibration and Testing (FACT) site. So when co-workers rushed in to tell him about a meteor the size of a bus that had exploded in a blaze of fire across the western Siberian sky, it was news to him.

"They came in the trailer and asked, 'Did we pick up the event?' and I said, 'What event?'" Darren recalls. "I went over to the station and pulled up the viewer and lo



BOLIDE DETECTED — This image shows the shortest path that infrasound waves from the meteor's explosion propagated from Russia to receivers in the US.

(Image data courtesy of Google earth and NASA)

and behold right in the middle of the screen was the event itself."

Darren saw small disturbances in the atmosphere detected 6,200 miles (nearly 10,000 kilometers) away in the quiet southeast corner of Sandia Labs and about nine hours after the meteor's explosion, called a bolide. The bolide occurred 12-15 miles above the Earth and released nearly 500 kilotons of energy. The meteor, which had an estimated mass of 10,000 tons, injured more than 1,000 people, mostly from breaking glass, according to NASA and media reports. It was the largest meteor reported since one hit Tunguska, Siberia, in 1908.

"Any time we can detect coherent signals by our infrasound array and see an event

that the rest of the world is seeing, that's a pretty neat thing to be part of that signal capture," Darren says. "From the distance, I was a little surprised to have picked it up,

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Sandia leads in large-scale passive optical network



SENIOR ENGINEER Steve Gossage (9336) looks at fiber optics in a cable box that replaced heavier and bulkier copper cable for high-speed communications throughout much of Sandia. Fiber offers more capacity and is more reliable than copper. (Photo by Randy Montoya)

By Sue Major Holmes

It took a lot to get that little white cable box with the dancing green lights on the walls in offices throughout Sandia.

The years-long effort has made Sandia a pioneer in large-scale passive optical networks with the largest fiber optical local area network in the world. It reaches 265 buildings and 13,000 computer network ports and brings high-speed communication to some of the Labs' most remote areas for the first time.

The conversion will save an estimated \$20 million over five years through energy and other savings and not having to buy replacement equipment. The network will reduce energy costs by 65 percent once it's fully operational.

Fiber offers far more capacity, is more secure and reliable, and is less expensive to maintain and operate than the traditional network using copper cables.

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Career capstone

This year Jeff Tsao became the 13th Sandian honored with an Asian American Engineer of the Year (AAEOY) award. The self-described "idea guy" has had a distinguished 29-year career at Sandia. Read about Jeff and his award on page 12.

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Influential woman

Dorothy Stermer, an accomplished 23-year Sandia veteran, has been named to an elite group of women in the state of New Mexico. She is one of 32 honorees in the 2013 Albuquerque Business First's "Women of Influence" awards program. Story on page 11.



That's that

Here's an astonishing fact (I'm easily astonished): A couple of weeks ago, the 25 billionth – that's with a "b," as they say – song was downloaded from the Apple iTunes store. The song, for the record, was "Monkey Drums (Goksel Vancin Remix)" by Chase Buch, an otherwise undistinguished piece of techno dance music now enjoying its 15 minutes of fame. Lucky Mr. 25 Billion received a €10,000 iTunes gift card from Apple. That'll buy him lots more monkey drums, some gorilla drums, and maybe even a bonobo drum or two.

According to an Apple news release about the milestone, consumers are now downloading songs at an average rate of 15,000 per minute from the store's 26 million-plus catalog. I'm old enough to find this all a bit astonishing. I remember when it was a big deal to buy a 45 rpm single record, which, as I recall, cost more than an iTunes download does now. And that was at a time when the dollar was worth three or four times what it is today. The thing about the record business back then was that there were only a limited number of labels and each label had only a limited number of artists in its stable. Once a song fell out of favor, it was replaced on store shelves with new content. It could be pretty hard to find a single of "Blue Velvet" (if for some strange reason you were inclined to do so) once it dropped off the charts. The record labels ruled and you either had a contract with a label or nobody ever heard of you. It really was that simple.

The iTunes store – and the related mp3 phenomenon in general – has changed all that. Today, anyone can sell their music to anyone else willing to buy it. As the Apple news release noted, the technology "leveled the playing field for musicians." Not only is the accessibility to markets vastly more open for musicians today, but affordable digital recording equipment, far superior to the gear you'd find in the best studios a generation ago, means you can work your magic in your own garage, upload it to the iTunes store or your own website, and then sit back and wait for the money to come rolling in.

And what's true in music is true, too, in book publishing and filmmaking. To borrow a phrase from the Marxists, the means of production are now in the hands of the people.

One hears of authors who are making big money – I'm talking seven figures – strictly through online sales of books that no "publisher" would touch. And some of the most interesting work being done today in the movie industry isn't being done by the "industry" at all, but by imaginative and visionary artists using digital technology.

This is all to the good, or mostly so. But there is a dark side to this trend. Just as artists can use technology to create works of beauty and power, so can bad guys use emerging technologies to do harm on a scale that was unimaginable a couple of decades ago.

We all know about the hacking culture: a lone wolf with an ax to grind, if he's smart enough and malicious enough, can do one heck of a lot of damage with a \$300 computer and an Internet connection. And, of course, hacking has morphed from the disorganized act of isolated malcontents to the ordered, sophisticated campaigns run by big-time criminal enterprises, state sponsors, and terrorist organizations.

As it has gone in the cyberworld so it seems to be going in the bio world as well. Sophisticated labs that once cost millions can now be assembled in a garage for a few thousand dollars. You can find the plans online. You could look it up, as Casey Stengel used to say. Biohackers – and let's be clear: not all of them intend to do harm and some may be advancing real research – are using homebrewed labs to go places that even the best-equipped labs couldn't go a decade ago. What are they brewing up in their garages and basements? Who's monitoring them? Where are the controls? That's the point: Nobody knows.

Part of Sandia's mission is to protect the nation by preventing technological surprise. That is, by anticipating where threats to America may come from and what shape they may take. As we continue to pursue that vision, we're going to have to look into some increasingly unlikely and probably very unsavory places. But if we don't do it, who will?

See you next time.

Bill Murphy (505-845-0845, MS1468, wtmurph@sandia.gov)

Working Well

A year of Accomplishments

Good things happen when we get together, when we take a moment to look around, when we share our thoughts with one another. We start to realize that we have a lot in common. Sure, we spend most of our lives at our workplace. Sure, we have strategic objectives to meet but, when we get together and talk about it all, we realize that we each have a part in a great community and one for which we mutually care.

Last year, some 700 people got together and shared their thoughts on the Virgin HealthMiles social platform, chiming in to the Working Well Group. The group shared their experiences around the campus, offered suggestions about what could make life better, and formed shared goals to improve our workplace environment. They took a moment to look around, to listen to one another, and to offer their support.

Here's a list of the Working Well Group's accomplishments in 2012:

- Offered wholesome brownbag lunches at all Sodexo cafés
- Added more whole fresh food on the T-Bird Café salad bar
- Accepting credit cards at the T-Bird Café
- Added healthier selections "Better Bites" to all campus vending machines
- Added onsite group fitness classes to improve access to exercise options
- Designated walking loops with posted distance markings throughout the campus
- Established a nursing mothers' room in Bldg. 831
- Planned the opening of a salad bar in Area 4 (2013)



A Sandia designated safe walking path

Here are some of the group's upcoming ventures:

- Add a food tracker to interface with the Virgin HealthMiles app
- Landscape a more walkable campus with shade and designated safe walking paths
- Create opportunities for mini-movement breaks/walking meetings
- Facilitate modified meeting schedules to encourage time for a 5-10 minute movement break
- Facilitate activity-focused team celebrations (as opposed to food-focused)
- Encourage team "lunch" breaks (group exercise sessions for work groups interested in moving together)
- Establish additional nursing mothers' rooms equipped with hospital-grade breast pumps

With all the good things that come from getting together, why don't we do it more often? The Working Well Group continues to meet and hopes you will continue to contribute your ideas. Think about what could make our workplace a healthier environment, what could make a difference in our workdays, and how you can help. Share with your Division Health Champ or login to Virgin HealthMiles Working Well Group.

To find your Division Health Champ, go to hbe.sandia.gov and search "health champs."

How to join the Working Well Group:

- Step 1:** Log in to your Virgin HealthMiles and select My Groups from the Connections tab.
- Step 2:** Type Working Well in the Search box and click the Search button.
- Step 3:** When Working Well appears, you can join Working Well by clicking the Join Group button.



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Sandia and Cool Earth Solar announce partnership

By Patti Koning • Photos by Dino Vournas

Under the bright California sun on Wednesday, Feb. 20, Sandia and Cool Earth Solar celebrated the announcement of a 5-year Cooperative Research & Development Agreement, the first public-private partnership to take full advantage of the Livermore Valley Open Campus (LVOC).



GUESTS AT THE PARTNERSHIP ANNOUNCEMENT EVENT get a first look at the first Cool Earth Solar unit in the demonstration area on the Livermore Valley Open Campus. Eventually, 100 or more units will fill this field.

"Today's announcement perfectly embodies how the open campus will enable and foster collaboration," said Div. 8000 VP Steve Rottler. "The DOE SunShot initiative seeks to make solar energy cost-effective and competitive with other forms of energy by the end of the decade. Cool Earth Solar shares with both Sandia and DOE a commitment to making solar energy more affordable and broadly accepted. Their technology offers an innovative pathway to meet that goal."

He also noted that Cool Earth Solar was founded by two former Sandia staff members, and Paul Dentinger, another former Sandian, is the current director of product development and project manager for the partnership. "This is another aspect of this partnership of which we are proud," Steve said.

As Steve introduced the many dignitaries and elected officials in attendance, one of Cool Earth Solar's test units in the LVOC Clean Energy Demonstration Field collected energy from the sun and fed it into the site's power grid. About 100 units will be added to the field over the next five years and up to 500 kilowatts of solar power could be provided to the site by 2018.

Researchers with Sandia's New Mexico solar energy program will help characterize and validate Cool Earth Solar's inflated, concentrated photovoltaic (CPV) technology. Cool Earth Solar takes an innovative approach to capturing solar energy, using inexpensive thin-film plastic to focus sunlight in 24-foot-long inflatable tubes. This enables the units to capture as much solar energy as more traditional solar equipment with less than half the materials in terms of weight and mass. The materials used are less expensive, further driving down cost.

"We are very proud to be here today demonstrating this technology," said Cool Earth Solar CEO Rob Lamkin. "It's a good day because the sun is shining and this is our first public demonstration of our technology. But we are just getting started. In the upcoming months and years, we are going to fill this field with our solar concentrators and make even more clean renewable energy to supply into the grid. From here, we will move on to deploy the technology elsewhere in California, across the United States, and throughout the world."

Newly elected Congressman Eric Swalwell (D-Calif.-15th), the ranking member on the House Science Subcommittee on Energy, related President Obama's recently issued energy efficiency challenges to Congress and the country. "The goal is to reduce our energy footprint over the next five years, make our businesses and homes more energy efficient, and strive for more public-private partnerships. I thought, well here in Livermore, we're already doing that. We are leading the way," he said.

Innovation, he added, requires a three-legged stool of access to capital, a brain trust, and a risk-taking culture. "You have the risk culture and the brain trust in the scientists and entrepreneurs, but access to capital makes economic development so difficult. That's why the federal public-private partnership is so important. Computers, airplanes, microwaves, the internet, antibiotics — all of these technologies came about because of federally funded research, because of partnerships between the federal government and private industry."

Kish Rajan, director of the California Governor's Office of Business and Economic Development, described the partnership announcement as another amazing milestone. "What we see here today is a public-private partnership — innovators joining with gov-

ernment at the local, state, and federal level to put together our resources to accomplish world-changing things, earth cooling in this case," he said. "I want to congratulate the hard work that has gone into this partnership and thank the leadership that made the Livermore Valley Open Campus possible."

"If I could sum up today in one word, it would be brilliance," said California State Senate Majority Leader Ellen Corbett. "The brilliance of a partnership between Sandia, the federal government, the state, and the innovation of Cool Earth Solar; the brilliance of the minds who created this technology and the minds at Sandia that will continue to develop this technology; and the brilliance of the sun."

The final speaker was Livermore Mayor John Marchand. "I could not have picked a more exciting time to be mayor of Livermore. It is my honor and privilege to welcome you to the dedication of this test site," he said. "At over 100 acres, the Livermore Valley Open Campus represents an important step in the modernization and development of the national labs that will change the future and define our new century. Because of many of you here today, this is happening in Livermore."

Also in attendance were Mike Hazen, VP of Infrastructure Operations Div. 4000; Rick Stulen, recently retired Div. 8000 VP; Bruce King (6112), principal investigator for Sandia's solar program in New Mexico; LLNL staff and management; and representatives for US Reps. John Garamendi (D-Calif.-3rd) and Jerry McNerney (D-Calif.-9th), State Senator Mark DeSaulnier, Assemblymember Joan Buchanan, and Alameda County Supervisor Scott Haggerty.

The CRADA with Cool Earth Solar will provide another dimension to Sandia's existing solar photovoltaics program. In addition to being the first public-private partnership to take advantage of the Livermore Valley Open Campus, the CRADA also represents a first for Sandia's solar program, with a testbed located at the Livermore site just a few miles from Cool Earth Solar's offices.

The testbed on the LVOC will be managed by Cool Earth Solar with guidance from the solar photovoltaics program, specifically on instrumentation and analysis. At the same time, staff in New Mexico will characterize performance of a smaller Cool Earth Solar unit in the Photovoltaics Systems Evaluation Lab. The CRADA allows Cool Earth Solar to draw upon Sandia's decades of experience in solar energy and expertise in high resolution photovoltaic measurement.

"The inflated, tubular design and curved front surface of Cool Earth Solar's units is quite unique and makes this an exciting project," says Bruce King (6112), principal investigator for the solar program.

The Sandia/Cool Earth CRADA also provides the opportunity to publicly demonstrate the value of broad-based, multi-site laboratory. "The combination of the accessible environment of the LVOC and local innovative ecosystem in California with the deep technical expertise of the New Mexico solar program created a compelling program opportunity to evaluate a promising new solar technology," says Andy McIlroy (8310). "The CRADA has opened new areas for collaboration between the sites including the potential to hire staff who report to the solar program in New Mexico and reside in California."

Sandia California News

New hydrogen book illustrates Sandia expertise in H2 storage

By Mike Janes

Though *Hydrogen Storage Technology – Materials and Applications* is perhaps a title only a scientist or engineer could love, Lennie Klebanoff (8367) is confident that the book's content will help give readers a greater sense of urgency about the need to get hydrogen fuel cell vehicles on the road, and other hydrogen-based power equipment into the marketplace.

Lennie, who serves as the book's editor and was co-author on half the chapters, knows his topic well. He was director of the now-completed Metal Hydride Center for Excellence (MHCoE), which was one of three DOE Centers of Excellence dedicated to solving the problem of storing hydrogen on automobiles. He's also led a successful effort to develop a fuel cell mobile lighting system, so it didn't come as a shock when publisher Taylor & Francis called one day and asked if he'd be interested in editing a new book on hydrogen storage.

He agreed, realizing that work on the MHCoE and in the other two Centers of Excellence had resulted in a great deal of technical data that was ready to be compiled and shared with the research community. In addition, Lennie says he feels a personal sense of responsibility to inform both technical readers and the general public about the urgent need to get zero-emission hydrogen technology into the nation's vehicle fleet and in other applications currently exacerbating our climate change problems.

"A lot of consumers, political leaders, and even some scientists don't seem to have a visceral understanding of how bad the global climate change problem really is, and that it has been with us for a century. The first chapter in this book tries to change that," Lennie says. In addition to that hot-button topic, the book also discusses fuel resource insecurity and political energy insecurity as viable reasons for the nation to convert to hydrogen-based vehicle and power technology (Lennie defines "political energy insecurity" as the political difficulties that can emerge when one country's energy needs are dependent on another country).

Hydrogen Storage Technology also addresses other technical issues, such as codes and standards, pressure

vessels, and engineered hydrogen storage systems. A chapter led by Terry Johnson (8366) reviewed the recent GM/Sandia project that developed the first engineered hydrogen storage bed that could satisfy the fuel demands of real automotive drive cycles. Ironically, Lennie himself — despite the technical theme of the book — says storage isn't the technical hurdle that some believe it to be.

"We actually make the argument that storage is not a huge barrier," Lennie says. "All of the major car manufacturers have produced hydrogen vehicles, and they can all run for at least 240 miles, and in some cases more." He acknowledges, however, that the government and industry target for any consumer vehicle is at least 300 miles, which has created a charge to the research community to develop a storage solution that will get beyond the 240-mile range. "But there is no technical hydrogen storage barrier preventing the rollout of the first hydrogen-powered vehicles today," Lennie asserts.

In addition to Lennie's own background, he drew upon the considerable hydrogen expertise at Sandia/California to complete the book. Daniel Dedrick (8367), Terry Johnson (8366), and Vitalie Stavila (8367) each contributed to various book chapters, and now-retired Sandia hydrogen program manager Jay Keller penned or co-wrote a pair of chapters as well. "It was a real team effort and clearly shows the level and breadth of hydrogen knowledge here at Sandia," Lennie says.

Outside reviews of the book have been excellent. Professor Klaus Yvon from the University of Geneva, an international leader in the hydrogen storage community, has called it "a breath of fresh air in the field of hydrogen storage research. This book is unique in that it combines materials science, physics, and engineering aspects on various hydrogen storage methods into a single volume, not forgetting application issues." Yvon adds that "it should be treated as compulsory reading for students and researchers in the field."

Those interested in purchasing *Hydrogen Storage Technology – Materials and Applications* can do so online directly from the CRC Press website, or at Amazon.com.

Optical network

(Continued from page 1)

An optical local area network (LAN) gives people phone, data and video services using half-inch fiber optic cables made of 288 individual fibers, instead of the conventional 4-inch copper cables. Copper cables used to fill up underground conduits and required steel overhead racks of connecting cable, along with distribution rooms filled with separate frames for copper voice and data cables. The fiber distribution system uses only part of the conduit and needs only a 2- by 3-foot cable box.

"The frames go away, and the walls are bare and the tray empties," says senior engineer Steve Gossage (9336), who has spent his 36-year career at Sandia in advanced information and network systems engineering.

Pushing the boundaries of speed

The national laboratory has always pushed for speed beyond the fastest transmission rate available, Steve says. "When people were working in much slower data rates, kilobit-type rates at short distances, we were trying to get 10 times the distance and 10 times the speed," he says.

Sandia began looking at fiber optics early in the technology's development because of its promise of higher bandwidth — greater communication speed — at longer distances. "A lot of credit goes to Rich Gay [8949]," says Len Napolitano, director of Computer Sciences and Information Systems Center 8900. "He was an early advocate decades ago for full optical networks at Sandia's California site, and has demonstrated it could work at a site-wide scale."

The Labs started converting from copper in the 1980s, first installing then-emerging fiber optics in a single building and bumping that facility to megabit speeds. "Today we're way past that. We're at 10 gigabit-type rates and looking hard at 100," Steve says.

After years of planning, Sandia completed a formal network plan in late 2008 and sought competitive bids the following year. Sandia selected Tellabs of Naperville, Ill., as the equipment vendor for the network, and Steve and his colleagues simultaneously began to jumpstart the deployment of the fiber infrastructure and set up a test lab to validate the performance of configurations for the equipment and various network functions. The technology began moving to desktops in 2011, and by the end of 2012, Sandia had converted more than 90 percent of bulky copper cable to a fiber optics LAN.

Sandia, which will spend about \$15 million on the project, needs superb computing capability for the problems it tackles as part of its support for the mission

for the National Nuclear Security Administration.

"Whether it's a materials science problem or modeling an event, we need a lot of data and a lot of processing capability," Steve says. "We need to be able to see it, we need to be able to view it, we need to be able to put teams together. This is a large laboratory, deeply stocked with scientists and engineers and test labs. For the analyses we get, the problems are not small and they're not easy."

Since its first experience with fiber optics, Sandia envisioned being able to use multiple wavelengths in a very high bandwidth single strand reaching the farthest tech areas. But decades ago, when Sandia began putting in single-mode fiber to desks and adding underground fiber capabilities, the technology wasn't quite mature enough to take advantage of fiber optics' inherent multiple wavelengths and speeds.

Waiting for technology to develop

Sandia continued to install the fiber optics cable foundation and waited as the technology developed, and moved quickly when commercial optical networks began deploying voice, data, and video to large collections of homes and offices.

"There weren't that many unknowns for us because we had been thinking about ways to do this on a large scale for quite a while," Steve says. "We had already thought through what this might mean to us, what it might mean to our lifecycle costs and where the investments would be, and we were already pretty comfortable with fiber and the technologies that go with it."

Buildings with conventional copper LANs have separate networks for phones, computers, wireless, and so on. Fiber optics puts everything in a single network cable. That eliminates a large number of power-consuming switches and routers and makes the network simpler to operate and cheaper to install. Since it requires less space, energy and maintenance costs go down.

"As we research and deploy new technologies our main objectives are to enable the Labs' mission, decrease life-cycle costs and if possible reduce our footprint on the environment. With the deployment of passive optical networks we have been able to meet and exceed all of these objectives," says manager Jeremy Banks (9336).

Where a conventional LAN serving 900 customers requires a space the size of three double ovens, an optical network serving 8,000 requires a microwave oven-sized space. Where copper cable required Sandia to maintain and manage 600 separate switches in the field, optical LAN allows it to operate a data center in one building and simple, standard ports to offices. Because fiber optics reaches beyond the 100-meter radius that once was the standard from a wiring closet to a desktop, remote areas such as the National Solar

Thermal Test Facility have high-speed communications for the first time.

The only copper wire for most of Sandia today is a short connection from the wall to the desktop. Everything behind the wall is fiber.

Going from copper to fiber

Moving away from copper wasn't easy. It required new technology for the core communication system and made Sandia its own network provider, Steve says. He credited a central team of about 10 people across Sandia who worked together every day throughout 2011, plus sub-teams totaling about 40 people. The effort included engineering design, information technology, network systems, computing, facilities, security, and people in the field pulling cable and connecting ports.

"Thank you' is just not quite enough when you see people working that hard for that long to assist in change, because change is hard and worrisome and disquieting," Steve says.

Sandia is recycling copper as it's replaced, which keeps tons of valuable material out of a landfill. The estimated \$80,000 for the copper will offset some of the fiber optics cost.

The Labs also must turn off hundreds of switches before it can fully realize the energy savings. That will take longer because it depends on such things as staffing, Steve says.

More change is possible

More change could be coming. A small trial is under way for voice-over-fiber — putting data and voice in one system rather than the two Sandia uses today. Testing shows Sandia can protect voice running through a congested circuit — what Steve calls "a Mother's Day test," when everyone calls at the same time. The Gigabit Passive Optical Network standard Sandia works with can dedicate part of the bandwidth and give priority to selected traffic such as voice. So calls would go through even with heavy competition from data.

Sandia also is working with a small number of researchers who need more bandwidth than they're getting. The Labs' needs are ahead of the market but it's pushing for next-generation increases in speed, Steve says.

Communication speed improves every five to eight years. With copper, each improvement required replacing large, heavy bundles of jacketed cable to re-engineer them to perform at the new speed, he says. Fiber optical cable offers a bandwidth good for 25 years or more.

"We change the wavelength, we change the modulation rate, we don't get back in the ceiling, we don't get back in the customer's office," Steve says. "So our return on investment, our capital investment, our operational investment, the impact on our customers — everything gets better."

Sandia instruments detect bolide

(Continued from page 1)

but then after hearing of the size, we weren't as surprised as we initially were."

Darren ran a simple analysis of the signals from an array of sensors at Sandia and determined the signal came from the north.

Kyle Jones, an infrasound geophysicist in Ground-Based Monitoring Research & Engineering Dept. 5736, is working on a more detailed analysis that could provide data for an international community of infrasound scientists.

Detecting pressure changes

The FACT site infrasound array detected the meteor's signal at a frequency of less than 1 hertz by the time it reached Albuquerque. Infrasound is the study of sound waves at frequencies inaudible to humans, less than 20 hertz, Kyle says. For comparison, a bumblebee's buzz is typically 150 hertz and humans hear in the range of 20 to 20,000 hertz.

At FACT, microbarometers — equipment first developed in the early 1900s that today are about the size of gallon milk jugs — are set up in arrays so that each sensor detects the atmospheric pressure change caused by the low frequency sound waves from the meteor's explosion at slightly different times.

Calculating the varying arrival times here and at other infrasound sensors in the Southwest, Kyle uses geometry to detect the back azimuth, or the direction the sound originated. He says the sound waves detected here passed over the North Pole, which was the shortest distance for the pressure waves to travel.

Kyle also calculated the effects of thermospheric, stratospheric, and surface winds on the sound waves and atmospheric temperature changes that bounce the waves back

to the ground multiple times during their journey. He calls this "ray tracing," which recreates what happened to the sound wave as it was propagating away from the source and toward Sandia's sensors.

"The fact that the FACT site detected this event at such a great distance and came within 200 kilometers of the source was very, very good," Kyle says.

Kyle believes the Chelyabinsk bolide is the farthest event the FACT site has ever detected.

"For this type of event, this is probably the limit, but it depends on the winds and the path that the sound is going to take," he says. "If the winds are favorable winds and the arrays are located at the right spot, it could carry much farther."

While Sandia's FACT site is not charged with monitoring nuclear explosions for treaty verification, it does have a research role in supporting the international community's nuclear monitoring.

Kyle is currently part of a team that is developing software in a research capacity that he hopes both the US and international communities will utilize that uses near real-time wind profiles in its infrasound analysis of suspected nuclear explosions. After Kyle analyzed the wind's effects on the Chelyabinsk bolide's sound waves, he reduced the range of the possible location of the explosion by about 185 miles (about 300 kilometers).

'Seismic is primary'

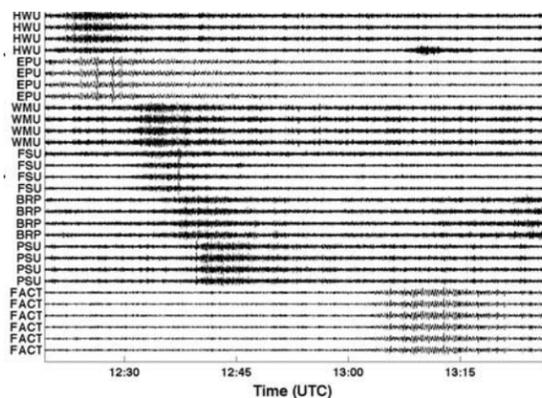
In the case of the recent meteor, the location was roughly known, but had the explosion happened where no one saw it, for example, over the ocean and unseen by ships, it would have been a mystery, Kyle says, so more accuracy in pinpointing the location would have been necessary.

"The international community uses infrasound as a secondary means of identification of suspected nuclear detonations. Seismic is primary," Kyle says. "I would say infrasound is important because it's another piece of the puzzle."

Infrasound can detect atmospheric detonations and the effects on the atmosphere from underground explosions, he says.

Infrasound also provides the United States with independent verification of what the international community is observing in its monitoring system and "it's a technology that we can share with them, so they can advance their understanding and they can help us advance ours," Kyle says.

The FACT site is being expanded from a few acres to sensors across 400 acres and Sandia — with help from DOE, NNSA, the State Department, and KAFB — is helping form a network of infrasound arrays in New Mexico, Arizona, Nevada, Utah and California, called the Southwest US Seismo-Acoustic Network (SUSSAN), which will provide more data to improve the accuracy of autonomously locating all types of infrasound events, both natural and man-made.



NORMALIZED WAVEFORM PLOT shows FACT's waveforms along the bottom of the graph along with those from the University of Utah. (Image courtesy of Kyle Jones)

New patent law

(Continued from page 1)

cation has the prima facie right to the grant of a patent. If a second patent application is filed for the same invention, the second applicant can institute a derivative proceeding to establish the first applicant derived the invention from the second filer. In such a case, the second filer is only entitled to receive a patent if he or she can prove the first applicant derived the invention from him or her.

“The concept of first-inventor-to-file is intended to streamline the patent process and reduce patent prosecution and litigation costs.”

— Chief IP Counsel
Kerry Kampschmidt



“The concept of first-inventor-to-file is intended to streamline the patent process and reduce patent prosecution and litigation costs,” Kerry says.

He says the changes “make it especially important to plan for IP protection early in the lifecycle of an R&D project. Be sure that inventions are protected by filing in the United States Patent & Trademark Office (USPTO) before they are announced at a conference or published in a paper. The patent community expects that inventions published before filing a patent application will set off a race for others working in that area to the USPTO.”

Rather than requiring absolute novelty, as most industrialized countries have, the US retained a one-year grace period under the AIA. An inventor may publicly disclose an invention and then claim priority rights back to the initial disclosure date when filing a US patent application directed to the invention within that one year. Nevertheless, an early public disclosure will bar the inventor from filing a patent application in most foreign countries, which have an absolute novelty bar to patenting an invention.

Even with the one-year grace period, inventors should be cautious to whom they publicly disclose an invention. Derivation proceedings allow inventors who publish to try to prove that an earlier applicant derived the invention from a publishing inventor, but it is unclear how the USPTO and courts will treat these claims. Lack of exact identity of the publication and the patent application may provide loopholes in derivation proceedings thereby allowing an earlier applicant to prove that there was not derivation of an

invention or an identity of the claimed subject matter and the earlier publication.

“As derivation proceedings are new and unique to the US, there is no precedent for predicting outcomes” Kerry says. “Proving derivation of an invention will present significant challenges. Applicants who have been working in the field will have lab notebooks, inventor notes, and other evidence of independent invention. Proving derivation of an invention will be difficult and expensive.”

Send it to Legal

Kerry says it is important that researchers talk to their patent attorney before publicly presenting or publishing information regarding an invention to be sure they understand the new law.

“Sandians should get their invention disclosures into the Sandia Patent and Licensing System (PALS) for review before publication,” Kerry says.

Articles generally don’t get published overnight. They have to be accepted. If a researcher sends a technical advance to the legal office at the same time the paper is submitted to the Sandia Review and Approval (R&A) process before publication, attorneys and partnerships’ staff will have time to evaluate it and go through a review before anything is published.

Working with the line, the Sandia technology partnerships organizations decide which technical advances fit within the corporation’s intellectual property strategy and are potentially patentable. Those selected are filed in the USPTO. “Once a patent application for a technical advance has been filed in the USPTO, inventors are protected and can then publish without concern,” Kerry says. “However, any subsequent changes or improvements to the invention may need to be protected by an additional patent application.”

One consequence of a third party obtaining a patent on a Sandia invention is that the government might have to pay royalties to another entity to use a Sandia-invented technology, essentially paying double. Sandia patents contain a notice that the government has rights to the invention. If Sandia invents something and somebody not using government funding files in the patent office before Sandia, the government rights won’t attach to the patent. Sandia doesn’t just lose the patent, the government loses its use rights in the invention.

Top-of-mind IP

The change fits with Sandia’s new IP Lifecycle objective promoting intellectual property management from the very beginning of project so that the results of R&D can be more powerfully deployed for the US public good. Launched last year, the strategy expects Sandians to think about IP development, protection, and deployment much earlier in a project lifecycle than has tradi-

tionally been done.

“If researchers are thinking about potential intellectual property at the beginning of their project and begin working with the partnerships organizations as soon as a technical advance is written, there is a much better chance that the IP can be appropriately protected and that commercial partners can be attracted who will license the invention and take it into the marketplace,” says acting VP and Chief Technology Officer Julia Phillips, who leads Sandia’s technology transfer efforts.

Several town halls on IP Lifecycle and the patent law change have been held in the past year. More training is being rolled out across Sandia with the goal of reaching everybody who works with IP in fiscal year 2013.

“The leadership team is working on IP strategies that will help guide our implementation of the IP Lifecycle.”

— Pete Atherton, Sr. Manager
Industry partnerships



“Our goal is to inform everybody who works with intellectual property so that the transition to the new law is smooth by being intentional about how we will manage our IP,” says Pete Atherton, senior manager of Industry Partnerships Dept. 7930. “The leadership team is working on IP strategies that will help guide our implementation of the IP Lifecycle.”

Kerry says the key to Sandia’s patent success under the new first-inventor-to-file system is forethought. “Think about the commercial potential or ability to attract funding partners using your invention. Being the first to file an application in the patent office directed to the invention is the best path under the new law.”

For more information

- Read more about the new patent law at info.sandia.gov/legal/intellectual/index.html. Click on “Patent Law Changes” under “Subject Areas.”
- A town hall with Chief Intellectual Property Counsel Kerry Kampschmidt and other members of the legal team focusing on the patent law changes will be held Tuesday, March 26, at 9:30 a.m. in the Bldg. 823 Breeze-way. It will be recorded and videostreamed.

Labs revitalize nuclear security infrastructure

By Nancy Salem

Sandia has completed \$199 million in facilities construction and repair as part of an 11-year national effort to revitalize the physical infrastructure of nuclear security enterprise sites.

The Facilities and Infrastructure Recapitalization Program (FIRP) was established in 2001 to reduce a long-standing backlog of deferred maintenance at the NNSA’s eight sites, including Sandia. Some \$1.9 billion was spent over 11 years on 900 design, construction, and repair projects. The program goals were accomplished one year early.

“The NNSA created the program to make its sites leaner, more energy-efficient, and to ensure the vitality and readiness of its nuclear security enterprise,” says Dawn Harder, Sandia Field Office FIRP program manager. “A primary goal was to help restore, rebuild, and revitalize the facilities and infrastructure at Sandia through the elimination of legacy deferred maintenance and excess space.”

Reduce a \$2 billion maintenance backlog

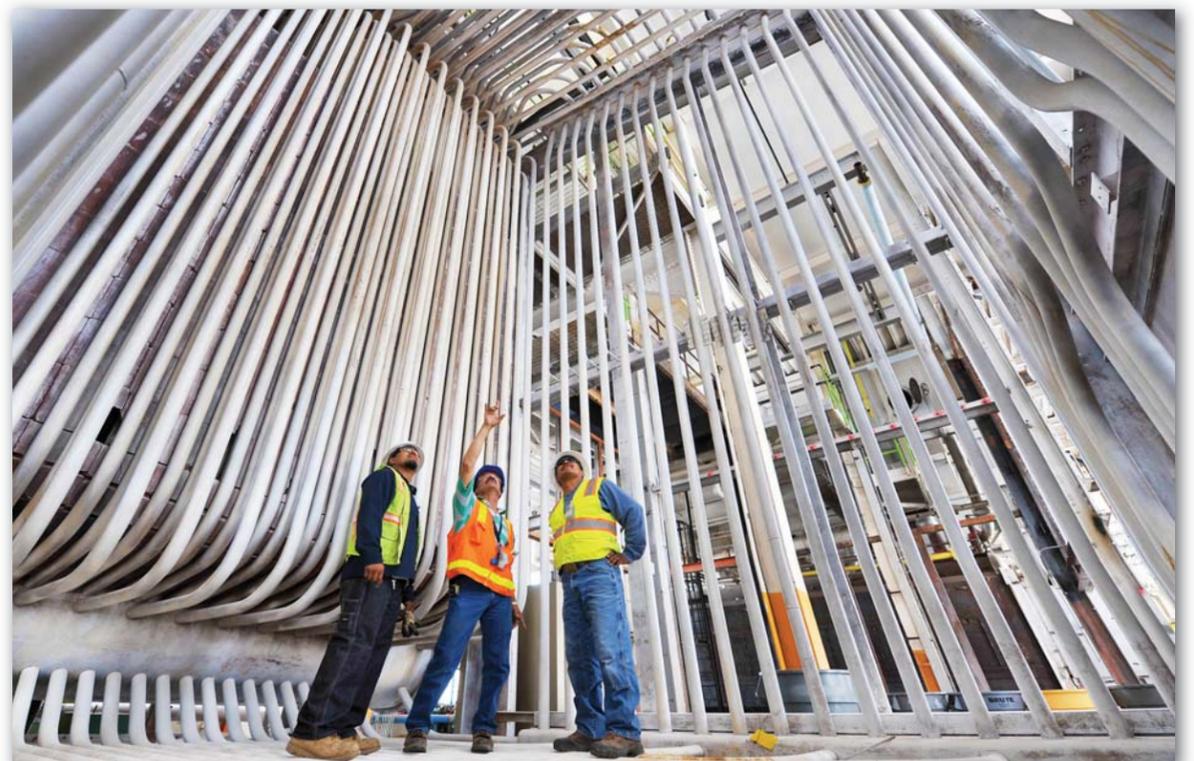
The FIRP came about after DOE and NNSA found significant deterioration of facilities that house activities of the Science Based Stockpile Stewardship Program. The FIRP was supported by DOE, DoD, outside stakeholders, Congress, and NNSA. The goal was to reduce a \$2 billion maintenance and repair backlog and restore facility conditions to an acceptable level through recapitalization, restoration, and modernization.

At Sandia’s three major sites in Albuquerque, Livermore, Calif., and Tonopah, Nev., the program eliminated \$142 million in deferred maintenance and 510,000 square feet of non-contaminated excess space. Sandia completed 56 recapitalization projects costing \$100 million; 21 disposition projects, at \$29 million;

two major utility line-item projects, \$62 million; and 18 infrastructure planning initiatives, \$8 million.

“The FIRP has been a cornerstone for Sandia’s efforts to achieve and efficiently maintain its facilities in a condition ‘fit for mission use,’” says Art Ratzel, director of

Sandia’s Facilities Management and Operations Center 4800. “Its performance exceeded our expectations through NNSA’s strong commitment and the tremendous efforts of Field Office and Facilities Management staffs in making FIRP an unqualified success.”



SANDIA’S STEAM PLANT was demolished in 2010 in the effort to dispose of obsolete facilities.

(Photo by Randy Montoya)

Cyber Engineering Research Laboratory formally opens

By Neal Singer • Photos by Randy Montoya

An unusual urgency underlay the brief speeches noting the formal opening of Sandia's Cyber Engineering Research Laboratory (CERL) on Feb. 19.

This was possibly because of a warning of "malicious cyber activity" released the previous day by the FBI and the Department of Homeland Security, and the growing flood of news releases from large institutions announcing — sometimes admitting — they had been cyberhacked.

The building — located in Sandia's Research Park — is expected to serve as a venue to bring together expertise from across Sandia, as well as from universities and businesses, to develop innovative solutions against the increasingly serious challenges posed by hackers and cybercriminals to individuals, business, and government.

US Sen. Tom Udall, D-N.M., mentioned Winston Churchill's book *While England Slept*, which in 1938 criticized the English government's lack of preparation against the threat from Nazi Germany. Said Udall, "Cyberthreat is not one of guns and tanks but we need to take it seriously. . . . The threat is real to . . . our water systems, oil pipelines, hospital systems . . . and we should bring justice to those who would do us harm. CERL is a crucial part of our defenses."

Said Sandia President Paul Himmert, "[Cybercrime] can't be tackled alone. The public and private worlds must combine efforts to work as a team." Sandia's cyberexpertise, he said, is rooted in its nuclear weapons history.

More than 300 Cyberdefender interns

He mentioned Sandia's Center for Cyberdefenders' student internship program (www.sandia.gov/ccd), which has worked with more than 300 students in the past decade to hone the skills of next-generation cyber workers.

Other CERL projects include marrying algorithms and data in attempts to prevent adversaries from penetrating emails or damaging websites.

US Rep. Ben Ray Lujan, D-N.M.-3rd) mentioned that



THE TRUTH AS I SEE IT — Sen. Tom Udall presents his views on the challenges facing the US in cyberspace, and what Sandians and CERL can do to help secure that useful but increasingly threatened arena. To the senator's right are NNSA official Dimitri Kusnezov, Albuquerque Mayor Richard Berry, and UNM Research VP McGraw.

"[cyberdefense] is critically important to our economy. Work at Sandia and Los Alamos national labs should lead to partnerships with private businesses." In terms of security, "personal information taken and used in some way, from an ATM machine or anywhere else, can allow someone from around the world to get into something personal [of a citizen's here]. . . . People in Virginia [at security agencies] seem to have connected the dots and released . . . information about the current threats."

NNSA official Dimitri Kusnezov said "the need for secrecy

[has ranged historically] from clay tablets and cuneiform to today's complex protocols. . . . Our cybersecurity needs will not recede in time but only get greater as data complexity gets greater. . . . There is no scientific silver bullet. The key is to train our people to be more aware, smarter, building in as many safeguards as we can, codeveloped with technology. Centers like this can forward these steps."

(Continued on next page)



POSED ON OPEN-HOUSE DAY are, from left, Acting VP of Science and Technology Duane Dimos, UNM research VP John McGraw, Executive VP Kim Sawyer, NNSA official Dimitri Kusnezov, Cray President Peter Ungaro, Sandia Computing Research Director Rob Leland, US Sen. Tom Udall, Sandia President Paul Himmert, Bernalillo county commissioner Maggie Hart Stebbins, and US Rep. Ben Ray Lujan.

(Continued from preceding page)

Albuquerque Mayor Richard Berry said he and the state's congressional delegation were on the same team in supporting the work at CERL. He mentioned the takeover of four TV stations by attackers jokingly advertising "the zombie apocalypse" was not funny in what it said about communications security.

Hacker adversaries getting more sophisticated

Peter Ungaro, president and CEO of Cray Computing, said "Cyber security is one of the largest threats out there today. . . . The vast amount of digital data is growing at an exponential rate — every two days, there's more data created than from the dawn of civilization to 2003. Our hacker adversaries are getting more sophisticated in using data against us."

Ungaro, who has made no secret of his admiration for Sandia in helping create what he termed "the most successful family of supercomputers ever built [based on the Sandia/Cray Red Storm supercomputer]," advocated working together at CERL to "develop a technical roadmap to take problems currently intractable and solve those to make them broadly applicable across a wide variety of frameworks."

UNM research VP John McGraw, who advocated "strengthening the interest and intent of UNM colleagues to create new research ties [with Sandia] in energy, security and water," also said that "Sandia's unique mission is to protect the public against vulnerabilities not recognized by the public."

Rob Leland, director of Computing Research Center 1400, said of the gathering, "I'm very touched by the turnout and by the excitement." Just as the development of the laminar flow cleanroom ushered in a revolution in microelectronics, he said, "There's the potential for us to do something similar in the cyber world and that CERL will play a key role in bringing that about."

Three CERL demonstrations following the talks included:

- A table-size interactive horizontal display on which large amounts of email traffic were represented. The screen demonstrated programs built to distill anomalies — harmful messages that are not what they seem, the sharks, so to speak, in the water — before they do damage;
- Students wearing electroencephalograph (EEG) caps who saw signatures of their brain activity as they exercised various computational skills — an effort to improve the human element of the cyber equation to ultimately train better cyber defenders, and
- Teams of students from New Mexico Tech, University of New Mexico, and local high schools who competed in a virtual cyber exercise to solve digital clues and catch a "bad guy."

Duane Dimos, acting VP for Science and Technology, served as master of ceremonies.

"I'd like to mention our thanks to the large Sandia team from across the Labs who did significant work to help the conference go smoothly," said Rob.

The ceremony is available for viewing on Sandia's internal website.

CERL is part of Sandia's Cyber Engineering Research Institute (CERI), which also includes Cyber Technology Research Lab (CTRL) in Livermore, Calif., and industrial and academic members. The institute's areas of interest include cyber data analysis, cyber modeling and simulation, cognition and human performance, and trusted systems.



LEARNING IS NEVER PAST TENSE — To an attentive audience of Rep. Ben Ray Lujan, left, and Sen. Tom Udall, Sandia researcher Laura Matzen explains the studies carried out in the cloistered room to her left. There, electronically monitored human subjects help build a graphic library of the brainwaves that correspond to success in meeting mental challenges important in cyberwork. The caps in the background to Laura's right are worn in the experiments.

Sandia-mentored high school team to compete in national cyber defense competition



THE CERL MIND-MELD — In the new building's RECOIL lab, up-and-coming high school student Tyler Morris and Rep. Ben Ray Lujan exchange a few words as Sandia President and Labs Director Paul Hommert listens in. Tyler, a year-round participant in CCD, is captain of the Cyber Patriot team at La Cueva High School.

By Stephanie Holinka

La Cueva High School's Marine Corps JROTC Program, mentored for the past two years by Sandia, is a top-ranked All Service team going into CyberPatriot V, a national high school cyber defense competition.

The competition is designed to introduce students to the foundations of cybersecurity. In each competition, students are given GNU-Linux or Windows virtual machines with several vulnerabilities on them. Students eliminate the vulnerabilities in a set period of time. Teams that find and neutralize the most vulnerabilities advance to the next round.

Students compete in either the All Service Division, which is open only to JROTC, CAP, and Sea Cadet Units, or the Open Division, which is open only to an accredited public or private institution or a registered home school association.

During the competition, contest designers provide participants with insecure machines that have been compromised in ways such as turning on legitimate services that aren't needed and can compromise security, and also by introducing malicious executables into the environment. Students then decide what to turn off, what to leave on, and what malicious programs need to be removed and cleaned-up after.

For the past two years, Chris Davis (5623) and Ted Reed (9312) have worked with the La Cueva team.

Ted says it's not easy to train students on issues related to cybersecurity, in part because students need compromised computers to train on, and most school and home computers are locked down.

During after-school practices, Ted says he and Chris gave students some security guidance about how to secure Windows and Linux machines and how to work with Linux. They helped students understand the problems and figure out how they could improve their security posture.

Ted says they tried to give the students principle-based understanding of computer security, especially the most important one: If you don't need the service, turn it off.

Chris says that, though the students began not knowing very much about cybersecurity, now they're able to fix things at the command line, and they do it naturally.

"Two years ago Ted and I were giving them very basic help. Today, they're asking us questions that are out at the edges of my understanding of things," Chris says.

This year, Chris says, the team placed first for round three in the All Service group and third overall in the competition. Prior to Chris and Ted's help, the teams were eliminated in the first round.

"I grew up with computers in my house, but these kids are digital natives; born within 10 feet of a cell phone. They think about things differently. Watching

how they operate has been eye-opening and educational for us," Chris says.

First Sgt. A. R. Griego, senior Marine instructor for La Cueva High School's Marine Corps JROTC team, says Ted and Chris have been a massive help to the team.

At first, Chris and Ted visited the school together. As the work progressed, they alternated weeks, while assisting students in creating a "playbook" intended to document the team's progress and to help train future team members going forward.

"It's been rewarding watching them go from average, perhaps mildly unprotected, computer users to people who are securing themselves and their families, Chris says.

Last year's team passed the documentation forward, Chris says, so this year's team started with the help and guidance of past teammates and their more-experienced peers.

Last fall, with support from Community Involvement Dept. 3652, Ted and Chris helped put together a Cyber Boot Camp for interested high school students. Around 25 La Cueva students came to Sandia's RECOIL room and participated in a one-day cybersecurity boot camp, running through CyberPatriot-style practice rounds. Future boot camps are planned for other local high schools.

Tyler Morris (5624), the team captain, joined Sandia's Center for Cyber Defenders (CCD) as a student intern last year. Using funding from the Department of Homeland Security's Science and Technology Directorate and tools from The Deter Project and University of Southern California's Information Sciences Institute, last summer Tyler and the other CCD interns developed training courses that could go into a controlled test environment, so they can be accessed online. He also worked on passing the team's knowledge and experience forward, helping to develop an iPod app for basic cybersecurity education.

Chris says a few other students from last year's team have pursued computer security-related college majors. But the experience has been beneficial for all of the participants.

"Even if they don't pursue it as a profession, their security hygiene has improved greatly. They know how to assess risks and protect their families. The more people protect themselves the less that governments and other official groups have to intervene," Chris says.

Though the preliminary CyberPatriot rounds were held online, the overall winners in the preliminary rounds will soon compete in the national championships in Washington, D.C.

The team, along with coach Alberto Griego, will travel to the National Finals Competition, which will take place March 14-16, in National Harbor, Md.

Moving forward, Chris and Ted hope to parlay this success into training other groups interested in cybersecurity.

Tracer FIRE forges future cyber defenders

By Stephanie Holinka
Photos by Randy Montoya

Recent news stories about international cyber attacks have underlined the importance of training the next generation of cybersecurity professionals, who must defend the nation's cyber assets from the ever-present risk of attack.

Computing and Network Services Center 9300 recently hosted 15 faculty and students at the Cyber Engineering Research Laboratory (CERL) to participate in the Tracer FIRE cyber defense exercise. The students visited Sandia under a DOE-funded pilot project to help students in minority-serving institutions improve cybersecurity education.

Tracer FIRE (Forensic and Incident Response Exercise), developed in 2008 by Sandia and Los Alamos national laboratories, trains cybersecurity responders from DOE and other government agencies in how best to respond to a cybersecurity event. Tracer FIRE simulates network intrusions, allowing response teams to learn how to diagnose and respond to a cybersecurity event.

In CERL's Research and Engineering Cyber Operations Intelligence Lab (RECOIL), students from Vorhees College, Bowie State, University of the Virgin Islands, North Carolina A&T, and Norfolk State University learned about cyber incident response, and forensic investigation and analysis, and delved into topics like file systems, memory layout, and malware analysis.

RECOIL's network is isolated, so exercise planners can introduce things like malware to the environment without endangering other networks.

Kevin Nauer (9312), Tracer FIRE's creator, says the training includes a mixture of lecture, hands-on training, and competitive exercises designed to provide students with the knowledge and practice to apply what they have learned in a real-world situation.

Kevin developed the narrative-based scenario with the help of human factors and group performance researcher Armida Carbajal (431) and key cyber incident responders and instructors John Jarocki (9516) and Ted Reed (9312).

After the classroom component, students then enter RECOIL as cyber warriors, and serve on an incident response team in a simulated disaster, Kevin says.

During the exercise, teams quickly identify important events on a network. They learn how to perform forensic searches and to collect and analyze data on NT file systems using the EnCase Enterprise forensic tool suite, which is the leading computer forensic solution in use by government agencies and corporations.

Dustin Franklin (5624), a graduate student intern in cyber research and education, says the team challenges begin on the software side, with teams answering Jeopardy-style questions about the software environment.



GETTING FOCUSED — College students participating in a Tracer FIRE exercise.

"Teams first download a file and must discover what was changed in the file and where that change came from. Depending on the order in which they answer these questions, the answers can take them in a different direction," Dustin says.

In the exercise that day, a rogue nation-state gained control of a fictitious company, SchmuxBux's Mission-Critical Coffee Pot. Teams triaged the network environment, looking for clues about what was compromised and who the offender might be.

As the exercise progressed, the test designers handed out a USB drive to each team, simulating an employee discovering a USB drive containing malicious code.

Teams defend their system

While the teams defend their system, they also evaluate and assess other teams' systems, Dustin says.

"We know that the best defenders are those who understand the attackers — what they do and how they do it. Simulating both defensive and offensive activities within the exercises allows attendees to practice maintaining network situational awareness, use forensic tools, and hone their teaming and communication

skills," says Kevin.

Because successful scenarios require a complex narrative with props and activities that build a strong story, not all the researchers are computer science majors. Some come from other areas such as human factors and cognitive science.

The diversity allows them to make the exercise feel real. Dustin says Tracer FIRE scenarios are based on actual attack scenarios the designers have seen in the workplace.

"A diverse research group lets us look at the experience in different ways to help us better tailor scenarios for a wide variety of participant skill levels, even within the same scenario," says Armida.

"We've analyzed what types of attacks we've seen in the field, and we re-create narratives based on them, which drives each team toward analyzing what happened and uncovering the agent responsible for the event," Dustin says.

Observers immediately notice that Tracer FIRE exercises are loud.

It's not a bunch of people just staring at screens, Dustin says. The teams talk loudly and excitedly among themselves, all to a driving beat of techno music.

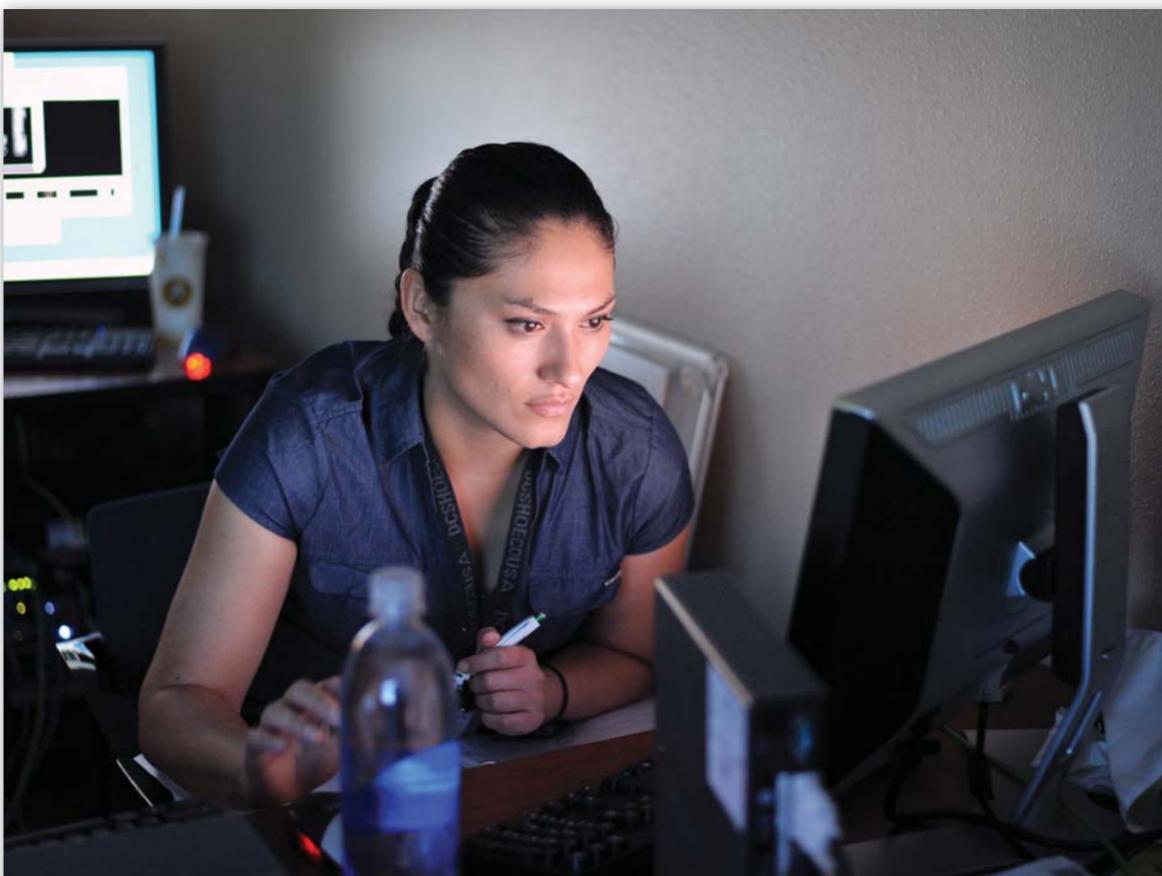
Armida says music helps set the tempo and intensity of the competition, as does dimmer lighting.

"Research shows that music and lighting affect mood and improve performance and also allow the teams to speak in a normal voice while still holding a private conversation."

Armida also captures performance data on the team and its individual members. Ultimately, researchers like Armida hope to instrument individual participants to further examine the cognitive factors that mark successful players and teams.

Ultimately, the RECOIL training exercise server and client environment, a software application that helps automate the administration of competitive exercises, will be open-sourced and made available to schools that participate, allowing university team members to extend the program's capabilities with custom exercises developed specifically to engage and more effectively educate and train minority students.

Kevin says students learn situational awareness and how to figure out what's really going on. The scenario puts those skills into a context that allows them to solve the problem, so eventually they can help the nation protect its information.



ARMIDA CARBAJAL (430) a statistician who studies human factors and group performance, follows the performance of individual participants and teams.

Keeping tabs on the world's dangerous chemicals

By Stephanie Hobby

In the chemistry labs of the developing world, it's not uncommon to find containers, forgotten on shelves, with only vague clues to their origins, and the label, if there is one, rubbed away.

Left alone for years, some chemicals can quietly break down into explosive elixirs, and what was once an innocent experiment by a well-meaning scientist becomes a very real, unsecured threat. Should such chemicals fall into malicious hands, the consequences could be widespread and deadly.

In 2007, Sandia chemical engineer Nancy Jackson (6823) helped the US Department of State create the Chemical Security Engagement Program to help scientists around the world, particularly in developing countries, keep chemical use safe and secure. Nancy and her team develop and implement programs for laboratories worldwide to help manage their chemical inventories and devote time to training future laboratory trainers.

As the 2011 president of the American Chemical Society and manager of Sandia's International Chemical Threat Reduction program, Nancy has traveled and worked closely with scientists in some of the world's most volatile regions to make their laboratories more safe and secure. For her extensive work engaging scientists around the world, the American Association for the Advancement of Science honored Nancy with the 2013 Science Diplomacy Award, presented on Friday, Feb. 15, at the AAAS annual meeting in Boston.

"Nancy has been a true pioneer in chemical threat reduction work globally. Even though the chemical threat has not received all the attention that the biological threat has, the ubiquity of dangerous chemicals and the means to misuse them makes the danger of chemical terrorism and proliferation just as clear and present as the biological threat," says Ren Salerno (6820), senior manager of Sandia's International Cooperative Threat Reduction program. "The recent crisis in Syria emphasizes this reality. The work of Nancy and her department is unquestionably a critical Sandia contribution to US and international security."

The program's goal is identifying chemicals that can cause catastrophe in the wrong hands, and making sure they stay out of those hands. One challenge facing Nancy and her team is that many laboratory chemicals are dual use, with both helpful and destructive applications. Take potassium cyanide. While cyanide is used to manufacture plastics, textiles, and paper, develop photographs and remove gold from its ore, when paired with an acid, cyanide can easily be turned into a deadly gas.

"Chemicals are not like nuclear or biological threat



SANDIA CHEMICAL ENGINEER Nancy Jackson (6823) has worked in laboratories around the world to help ensure that chemicals are used safely and kept secure. The American Association for the Advancement of Science honored her with the 2013 Science Diplomacy Award on Friday, Feb. 15. (Photo by Randy Montoya)

materials. They are everywhere," says Nancy. "You can't lock them up; you can't put them in Biosecurity Level 4 labs. Instead of locking them up, you have to manage them."

Nancy and her team work with universities, small businesses, and research institutions to build extensive chemical inventories so organizations can know and manage what they have. With such inventories, chemicals are less likely to go missing, and sharing resources between scientists is easier, driving down costs and wait times associated with ordering new products.

The program regularly engages scientists in the Middle East and Southeast Asia, where Nancy says chemists and chemical engineers understand the importance of keeping chemicals guarded, but often don't have the resources or training to implement security systems.

Nancy and her team have developed five-day, train-

the-trainer programs for chemists and chemical engineers that teach the importance of personal protective equipment, maintaining working chemical hoods, chemical management, and physical security. The goal is to educate professors and researchers so that program graduates will be aware of safety and security measures, thus sustaining the program for future graduates.

Despite the important national security mission of Nancy's work, she says one of the most rewarding aspects of her job is building relationships, particularly with the growing population of female chemists and chemical engineers in the developing world.

"It's a delight," Nancy says. "I love meeting these very impressive people and getting to know them, and I try to help their careers however I can. It has been a very rewarding career and I am honored to be recognized for my work."

Caterpillar CRADA opens door to multiple research projects

By Nancy Salem

Sandia and industrial giant Caterpillar Inc. have signed their first umbrella Cooperative Research & Development Agreement (CRADA), opening the door to a wide range of scientific research.

"This agreement will lead to an expanded relationship with Caterpillar," says Vic Weiss (10012), the business development specialist who helped negotiate the CRADA. "It's a strategic collaboration."

The Labs had a pair of standard CRADAs with Caterpillar a decade ago, each dealing with a specific project in diesel combustion. The umbrella CRADA has a broader scope, covering multiple projects in a variety of categories over three years.

The CRADA authorizes work in computer and computational science, information and data analysis, mathematics, engineering science, and high-performance computing. Technical categories include simulation design exploration, advanced analytics, multi-physics engineering modeling and simulation, and high-performance computing. The agreement includes training, education, technical support, and staff visits.

"We're excited about this new CRADA. We hope to do many new projects with Caterpillar in different technical areas," Vic says. "These agreements benefit our partners and Sandia by allowing us to do more research and advance our scientific knowledge. We learn when we partner with industry."

CRADA partners share the cost of research, inventions, copyrights, and patents. Legal terms and conditions are negotiated just once, so each new project does not have to go through that process.

Caterpillar is the world's leading manufacturer of



SANDIA COMPUTER SCIENTISTS Brian Adams (1441), left, Jim Stewart (1441), and John Sirola (1465) look over the results of a Dakota optimization study. Caterpillar Inc.'s interest in Dakota, an open-source software tool developed by Sandia, launched talks that led to the signing of a Cooperative Research & Development Agreement. (Photo by Norman Johnson)

construction and mining equipment, diesel and natural gas engines, industrial gas turbines, and diesel-electric locomotives. The company is looking to Sandia to help it develop advanced modeling and simulation technologies for virtual product development.

The first project under the agreement focuses on optimization in support of Caterpillar's product engineering, says Jim Stewart, manager of Optimization and Uncertainty Quantification Dept. 1441.

"Caterpillar wants to work with us on software capabilities to help do optimization studies on their engineering designs," Jim says.

The work will involve Sandia's Dakota open-source software tool that helps researchers adjust and assess the accuracy of computational simulations. Dakota shortens design cycles and cuts development costs.

"Caterpillar's interest in Dakota initiated the discussions about a CRADA," Jim says. "Dakota is installed in their system but they have a need to tailor it in ways to make it work better for them."

Chris Ha, a manager in Caterpillar's Information Analytics Division, says the company "is excited to collaborate with Sandia in the optimization and uncertainty quantification space focused around Dakota."

"We recognize that Sandia is one of the world's leading experts in these fields, and this relationship will help enable opportunities for Caterpillar to leverage such expertise," he says.

Sandia will provide training and research. Another effort will combine the capabilities of Dakota and a newer software package, Pyomo (Python Optimization Modeling Objects), to provide a wider range of optimization capabilities. Pyomo is a Sandia-developed open-source tool for formulating and manipulating algebraic models within the Python programming environment.

"We've had an interest in getting Dakota and Pyomo to work together in the software sense," Jim says. "This is something we've wanted to do and now we can through this CRADA."

Jim says the project will lead to other avenues of research. "The aim is to get some good work started and build from it in future projects."

Mileposts

New Mexico photos
by Michelle Fleming



George Cordova
35 27123



Stanley Kawka
35 400



Larry Moya
35 25481



Ray Gabaldon
30 10629



Charmaine Grabowski
30 10578



John Henfling
30 1515



Ann Riley
30 10222



John Cresap
25 2611



Terry Litts
25 25413



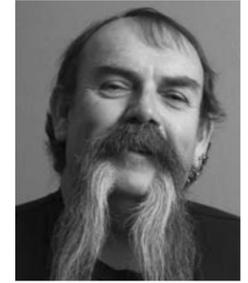
Hans Oldewage
25 2917



J.L. Sherer
25 9544



Steve Trujillo
25 4824



David Van Ornum
25 2732



Danny Donald
20 4122



David Furgal
20 6832



Denise Taylor
20 3554



Luna Casias
15 27123



Joanne Dodge
15 4221



Mickey Fitzpatrick
15 3333



Kevin Lederer
15 96



Michael Oliver
15 2554



Corey Reitz
15 9311



Michael Rimbert
15 2662



Paula Sanchez
15 423



Scott Stephens
15 9329



Polly Wilks
15 2555



Larry Zamora
15 6623

PreMedicare Retirees Must Complete an Online Health Assessment to Receive 2014 HRA Funds

During the 2013 Open Enrollment period, Sandia announced that PreMedicare retirees, as well as covered PreMedicare spouses, PreMedicare Surviving Spouses, and PreMedicare Limited Term Disability (LTD) Terminees must complete an online health assessment through their current administrator (BCBSNM, Kaiser, or UHC) in 2013 in order to receive 2014 HRA funds. Health assessments must be completed Jan. 1, 2013, through Sept. 30, 2013. Other covered dependents (i.e. children) are not required to complete the health assessment.

2014 HRA Funds Allocation		
Coverage	Annual allocation of HRA dollars if health assessment is taken	Annual allocation of HRA dollars if health assessment is NOT taken
Retiree Only	\$250	\$0
Retiree + Child(ren)	\$500	\$250
Retiree + Spouse	\$500	\$0
Retiree + Spouse and Child(ren)	\$750	\$250

Here are the instructions to complete your health assessment for each of the three administrators.

Blue Cross Blue Shield of New Mexico



BCBSNM members can access the health assessment as follows:

1. Log in to Blue Access for Members at www.bcbsnm.com using your BAM username and password. In the top right corner under "Quick links" there is a link that says "Health Assessment." This will take you directly to the page to begin the assessment.
- or
2. Go to www.wellontarget.com and log in using the same BAM username and password. If you have not completed your Health Assessment, the first screen to pop up will include a large orange and black icon that says "Click Here to take your Health Assessment."

UnitedHealthcare



UHC members can access the health assessment as follows:

1. Log on to myuhc.com.
2. Click the "Health Assessment" tab on the right side of the home page.
3. Select "I Agree" if you accept the Terms and Conditions.
4. Enter your height, weight, and e-mail information. Select "Save."
5. Choose English or Spanish. Select the "Launch University Health Assessment" link in the middle of the page.
6. Complete the Health Assessment and select the "Submit to University of Michigan for Analysis" button at the bottom of questionnaire.

Kaiser Permanente



Kaiser members can access the health assessment as follows:

1. Go to kp.org/healthylifestyles or kp.org/succeed.
2. You'll need to register with kp.org to participate.
3. If you haven't registered yet, go to kp.org/register.
4. Then sign on with your user ID and password.

Sandia Classified Ads Sandia Classified Ads Sandia Classified Ads Sandia Classified Ads

MISCELLANEOUS

WINSOR PILATES CD SET, \$45; exercise trampoline: \$50; Mickey snow globe, \$40; Z-Coil shoes, size 8, \$50; '11 Felt F85 road bike, \$600. Owens, 235-8671 or padillaowens@q.com.

BUNK BED, wooden, full bed on bottom, twin on top, \$200; TV stand, black glass, 3 shelves, 52-in., \$125; sofa & loveseat, cloth, Broyhill, medium brown, \$500. Salmon, 899-8749.

MAGNETIC TWIN MATTRESS TOPPER, Nikken, great health benefits, Google it, \$75. Lee, 720-5994.

KITCHEN TABLE, early American, 36" x 18", w/extension, \$175; Joe Rocket motorcycle jackets, men's (L) \$100; women's (S) \$75; women's leather chaps, \$85. Willmas, 281-9124.

2-IN-1 SWING/BOUNCY SEAT, Graco, Sweet Pea collection, like new, barely used, originally \$120, asking \$45. Moser, 980-2232.

POPEJOY TICKETS: 3/24, Eleanor-Loretta Swit, \$58/pr.; 3/30 Momix: Botanica, \$68/pr.; 4/6 Spamalot, \$128/pr.; front row, orchestra. Hardy, 259-3016.

MIXER, Cuisinart SM70, heavy-duty, w/food processor & blender, \$250; Janome 300E sewing machine, paid \$995, asking \$525. Jones, 881-1918.

RADIAL ARM SAW, Craftsman, 10-in., ~10 yrs. old, \$250 OBO. Konkel, 235-8085 or 298-4403, ask for Marty.

REFRIGERATOR, side-by-side, Whirlpool Gold, black, curved front, water & ice in-door, w/2 water filters, \$350. Laros, 505-890-0657.

TABLE SAW, Delta, model 36-600, 10-in., rolling stand, T-square fence, miter gauge, manual, new condition, \$175. Johnsen, 250-8417, ask for John.

TABLE SAW, Craftsman, 10-in., \$95; Kenmore refrigerator, 32-cu. ft., \$80; Kenmore electric stove, \$50; Kenmore gas stove, \$75. Gonzales, 296-8006.

ADULT LIFT TICKETS, 4, Red River, \$45 ea.; LED-LCD TV, Sansui, 24-in., bought 6 mos. ago, \$170. Brewster, 238-4704.

CD/DVD SHELF UNIT, oak, 500+ CD capacity, \$30; Southwestern-style pottery painting, 42" x 30", \$30; photos on request. Cocain, 281-2282.

LEATHER EQUIPMENT, excellent condition: stitchee, working table, patterns, photos available, \$2,200 new, asking \$950. Brown, 385-7562.

BATHROOM MIRRORS, 2, frameless, 3' x 4' x 1/4", \$40 ea. Smith, 898-8429.

REFRIGERATOR, GE, \$150; vintage Chambers Md1.61C gas range, \$500; beveled wall mirror, 48" x 30", \$50; photos available. Allman, 299-2438 or r_allman@q.com.

DINING ROOM TABLE & CHINA CABINET, oak, \$1,200; 5-pc., mauve sectional, \$700; 5-pc., bedroom set, \$1,000; photos available. Gallegos, 505-463-1553.

SHOES, Caparras Narita Magenta satin, size, 6.5, new-in-box, \$32, text for photos. Valdez, 702-6767.

FILING CABINET, metal, 4 drawers, \$85; aluminum ladder, 16-ft., \$55; RV tow bar w/accessories, used twice, \$325; towing accessories, reasonable prices. Garcia, 554-2690.

WESTERN HORSESHOW CHAPS, custom-made, worn twice, smooth, black leather, originally \$350, asking \$250. Rivers, 720-4701.

BEDROOM SET, Broyhill Fontana, twin bunk beds, w/ladder, 2 side boards, 2 Sealy mattresses, dresser, desk, 2 hutches, good condition, \$1,000 OBO. Golden, 505-823-9656.

COMPUTER TABLE, modern, multi-level, adjustable, metal, \$75 OBO. Stubblefield, 298-2991.

COUCH & CHAISE LOUNGE, adjustable back, sage green, \$249 and \$195. Smith, 505-306-1760.

ARMOIRE, w/sliding drawers for computer & printer, solid oak, beautiful, 2-drs. close unit, \$700. Hussong, 505-332-3523.

LEATHER COUCH, dark brown, 3-cushion, no reclining, call for photo, \$100 OBO. Schoenherr, 920-655-1577.

100% WOOL RUG, w/deluxe backing pad, red, like new, must see, \$500 OBO. Lambert, 505-453-2184.

FRAM AIR & CABIN FILTER, for '08 Toyota Tundra 5.7L, brand new, \$25/both. Hennessey, 915-241-8634.

WASHER & DRYER, electric, Whirlpool, used, work great, you pick up \$150, delivered, \$250. Yuan, 213-234-8404, leave message.

ABOVE GROUND POOL, Doughboy, 25-ft. diameter, 15,000-gal., red-wood deck, all equipment, free for removal/clean-up. Rea, 286-0286.

TRAIN TABLE, for electric trains, can email photos, price negotiable; Ablounge, used only once. Grumblatt, 294-4738, dolores-grumblatt@msn.com.

PRINTER/FAX/SCANNER, HP Officejet J64500, w/all manuals, like new, \$75. Garcia, 280-5815, ask for Frank.

GRANDFATHER CLOCK, beautiful, old, purchased in Hamburg in 1955, F. Schlesicky, Frankfurt on face, \$500. Jones, 771-8020.

RABBIT HUTCH, 2 hutches, small cage, 2 carriers, all or part, see at <http://flic.kr/s/aHsjCfsFXu>, make offer. Sjaardema, 856-6139.

How to submit classified ads

DEADLINE: Friday noon before week of publication unless changed by holiday. Submit by one of these methods:

- EMAIL: Michelle Fleming (classads@sandia.gov)
- FAX: 844-0645
- MAIL: MS 0165 (Dept. 3651)
- DELIVER: Bldg. 811 Lobby
- INTERNAL WEB: On internal web homepage, click on News Center, then on Lab News link, and then on the very top of Lab News homepage "Submit a Classified Ad." If you have questions, call Michelle at 844-4902. Because of space constraints, ads will be printed on a first-come basis.

Ad rules

1. Limit 18 words, including last name and home phone (If you include a web or e-mail address, it will count as two or three words, depending on length of the address.)
2. Include organization and full name with the ad submission.
3. Submit ad in writing. No phone-ins.
4. Type or print ad legibly; use accepted abbreviations.
5. One ad per issue.
6. We will not run the same ad more than twice.
7. No "for rent" ads except for employees on temporary assignment.
8. No commercial ads.
9. For active Sandia members of the workforce, retired Sandians, and DOE employees.
10. Housing listed for sale is available without regard to race, creed, color, or national origin.
11. Work Wanted ads limited to student-aged children of employees.
12. We reserve the right not to publish any ad that may be considered offensive or in bad taste.

VACATION RENTAL, sleeps 6, Fraser, CO, near Winter Park, July 26-Aug. 2, \$600/wk. Buck, 353-2667.

CAMERA, Casio EX-5200, new, \$65; bassinet, Kolcraft, 3-in-1, like new, \$85; sewing machine, Pfaff 1371, very good condition, \$375. Greene, 299-6302.

SOFA, dark gold paisley print, very good condition, \$175; recliner, faux mocha leather, excellent condition, \$250. Goetsch, 892-8366.

ROWING MACHINE, Precision USA 710, works great, compact, pretty easy to move around, \$50. MacCormick, 967-7891.

STORAGE SHED, Tuff Shed, 12' x 16', pitched roof, locking door handle, finished exterior, like new, beautiful, \$3,000. Romero, 350-5811.

HUGE YARD SALE, March 8-9, designer clothes, Star Wars, games, dishes, glassware, household items, 2423 Wisconsin. Langwell, 350-1315.

TRANSPORTATION

'11 TOYOTA CAMRY, 4-cyl., 52K highway miles, great condition, \$10,000. Cook, 916-6793.

'99 FORD EXPEDITION LARIAT, V8, 4WD, leather, 122K miles, excellent condition, \$4,500 OBO. McKee, 280-8999.

'10 TOYOTA HIGHLANDER SPORT UTILITY, 2WD, 4-cyl., AT, white, 86K miles, \$17,000. Thomason, 505-358-1813, ask for Gerald.

'05 SUBARU LEGACY GT LIMITED, Turbo, 5-sp., loaded, spoiler, 95K miles, \$8,700. Reeder, 867-4901.

'98 GMC SAFARI PASSENGER VAN, SLE, seats 7, white/bronze, removable seats, 138K miles, good condition, clean, \$3,500. Green, 281-4533.

'01 FORD EXPLORER XLT, 4-dr., AT, 4WD, meticulous service records, 171K miles, excellent condition, \$4,500 OBO. Adams, 505-934-2914.

'06 SCION xB, inspection at LHM Toyota, key repairs completed, 112K miles, \$7,200. Wolfgang, 505-414-1483.

NISSAN 350Z, enthusiast model, blue, AT, extended warranty, 65K miles, excellent condition, free oil changes, \$17,000. Derks, 321-1478.

'09 SMARTCAR PASSION, hatchback, AT, power, AC, heated leather seats, alarm, black, 18K miles, \$9,000 OBO. Sanchez, 505-350-3267.

'03 FORD CROWN VICTORIA, white, original owner, nonsmoker, Michelin tires, 42K miles, book \$6325, asking \$5,700 OBO. Hole, 255-1444.

RECREATION

MOUNTAIN BIKE, Trek 4900AL, 17.5" frame, 24-sp., shianno, rock shox, off-road 3 times, great condition, \$100. Mowry, 238-0363.

'03 HARLEY-DAVIDSON 883 SPORTSTER, Screaming Eagle pkg., garage kept, only 3,200 miles, \$5,000. Lucero, 385-0487.

'05 YAMAHA V-STAR, Classic Silverado-1100, low mileage, loaded, many extras, like new condition, call for more info. Marquez, 358-5725, ask for Tony.

MOUNTAIN BIKE FRAME, women's Trek 830, 17-in. \$65. Hammond, 821-0284.

REAL ESTATE

3-BDR HOME, 2 baths, ~1,310-sq. ft., many updates, new roof, RV launch pad, 5 mins. to KAFB, FSBO, \$165,000. Tapia, 263-1680.

3.5-ACRE HOMESITE, level, square, well, temp. electric pole, phone, read-to-build, no rocks, \$129,000/terms, \$10,000 down. Mihalik, 281-1306.

3-BDR. HOME, 1 bath, 1-car garage, all appliances, landscaped yards, auto-sprinkler system, Princess Jeanne, \$114,900. Carson, 822-0142.

TRIPLEX, ea. unit 1-bdr., 1 bath, 530-sq. ft., near KAFB, good income property, newer AC, wood/tile floors, MLS# 729035, \$119,000. Lioce, 697-9521.

WANTED

STUDENT ASSISTANCE, needed evenings & weekends, assist disabled person organize, file, scan & shred docs, \$10/hr. Shannon, 505-250-4451, abqthome@gmail.com.

CLASS A OR C RV, up to \$30,000, must be in good shape. Lopez, 505-296-7698.

JEEP GRAND WAGONEER, pre '91, old large-body style, mechanical problems OK, call me with leads too. Brothers, 401-6140.

DRUMMER, must like reading/playing challenging repertoire, Mondays, 6-8 p.m., Bosque Farms, <http://www.thevcbbnm.org>. O'Toole, 382-6051.

GOOD HOME, 4 healthy cats, spade/neutered, all over 6 mos. old, owner retired, moving out of state. Zanders, 505-299-6856.

CLASSICAL STRING PLAYERS, amateur adult intermediate violinist, looking for group to play with just for fun. Connelly, 575-770-0252.

MOVING BOXES, will pick up. Arpin, 286-4076.

SUGGESTIONS, alternatives to trashing 25 yrs. of National Geographic semi-annual leatherette volumes. Kelly, 299-3527, kellyfam@nmia.com.

MEN'S PING GOLF CLUBS, orange dot. Bell, 286-8275.

INDIVIDUAL(S) TO PERFORM YARD WORK, from early spring-early fall, mowing, trimming, haul away, Wyoming/San Francisco NE area. Diaz, 821-0868.

ROOM TO RENT, for SWAN student intern, starting end of May to August. Walther, 821-0949.

LOST AND FOUND

FOUND, silver feather earring, near gate G (medical). Wright, 379-5898.

Sandian honored by New Mexico Women of Influence

By Stephanie Hobby

Dorothy Stermer (5573) has been named to an elite group of women in the state of New Mexico. Dorothy is one of 32 honorees in the 2013 Albuquerque Business First's "Women of Influence" awards program, which highlights women who are leaders in the state's industries, professions, and organizations, and who excel in business and the community.

Dorothy has long been an advocate for women, both at work and in the community. As one of a handful of female graduates in the University of New Mexico's chemical engineering program, she knows the importance of educational opportunities and scholarships for women pursuing STEM fields, and believes it is equally important for women to support one another's success. In 1996, Dorothy co-founded the Sandia Women's Inreach Network, which was focused on developing skills and leadership of women. The program was a compliment to Sandia's Women's Program Committee, which was responsible for recruiting women to Sandia. The programs continue today as the single Sandia Women's



DOROTHY STERMER

Action Network.

"I really believe that as we raise one person's capability and contributions to our community, that benefits everyone," Dorothy says. "In every leadership role I have held, whether at work or in my volunteer work, I have made it a point to look for the good in every person and to inspire them to be more than they thought they could be."

In her 23 years at Sandia, Dorothy has been recognized for her contributions to a variety of fields. She is manager of the Flight Materials Management group, which supports DS&A and other internal customers by providing bonded controls of critical expensive materials and hardware to exacting quality requirements. She is also manager of the Management Assurance Department, and is responsible for program cyber and network security, network system administration and information management. She has led teams in environmental restoration and pollution prevention. Most recently, she was the Program Manager for Lockheed Martin/Sandia Strategic Technical Partnerships.

In her free time, Dorothy gives back generously to the local community. She has taken on leadership roles for well-known non-profits that help promote local culture, education, and the economy. She serves on the Opera Southwest board of directors, and leads committees and educational programs for the Southwest International Folkdance Institute. A large part of her volunteer work is through the United Way, where she helps evaluate funding applications and serves as a mentor to young women. She has spent years on pan-

els, often as the chair, to review applications for United Way funding.

"In doing so, I saw many amazing things that really important organizations are doing in our community with so little money. The commitment that people have to helping our society is incredibly impressive," Dorothy says. "To see our community money being put to great use, and helping direct nonprofits to specific resources, is just heartwarming. I'm very proud of that."

For the past seven years, she and her husband have co-managed the New Mexico Networking Links website (NMnetlinks.com), which provides networking opportunities for more than 3,200 subscribers and helps connect people to gainful employment. Finally, over the past 20 years, she has served as a mediator for government and community groups in town, consulted for organizational strategic and tactical planning and implementation with local nonprofits, and volunteered in various Sandia-led education and community outreach programs.

"I want the organizations that I'm associated with – and that I work hard for – to have positive visibility and that includes Sandia," Dorothy says. "I know I have access to further education and experience because I work at Sandia. Not everyone has that opportunity, so it's important for me to give back to the broader community and spread the wealth."

The award banquet was held at Sandia Casino on Friday, Feb. 22. More information is available at <http://www.bizjournals.com/albuquerque/event/62811>.

Prestigious award caps a wide-ranging career

By Nancy Salem

Jeff Tsao has seen it all in his 29-year Sandia career, from research to management to entrepreneurship. But being an idea guy is what he likes best.

"It's what I naturally gravitate toward," Jeff (1120) says. Jeff is a researcher in the solid-state lighting group, working to cut back the worldwide cost of electricity by using semiconductor light-emitting diodes as sources of illumination rather than electrical filaments, plasma, or gas.

This year Jeff became the 13th Sandian honored with an Asian American Engineer of the Year (AAEOY) award. The prestigious recognition program was started in 2001 by the Chinese Institute of Engineers-USA to honor outstanding Asian American professionals in science and engineering for their leadership, technical achievement, and public service.

This year's 12th annual event was held March 2 in Dallas as a finale to National Engineers Week. Albuquerque hosted the 2012 AAEOY last March with Sandia President and Laboratories Director Paul Hommert as keynote speaker and three Sandia honorees.

Since 2002, some 160 engineers from leading US technology corporations, research institutions, and the US Armed Forces have received the AAEOY award, including seven Nobel laureates.

"Getting this award is an amazing honor," Jeff says.

Caught in a blizzard

Jeff is a Los Angeles native who attended Stanford University. "I grew up playing piano and started college as a music major but realized music is a tough profession," he says. "After the first year I thought maybe I should do something different, so I switched to math."

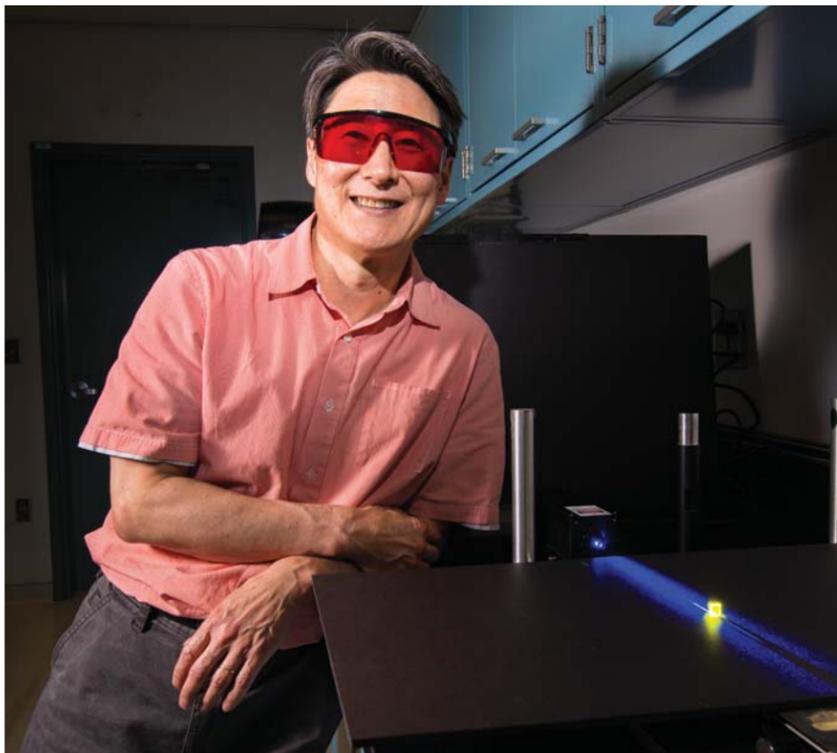
Jeff also became interested in physics and engineering and in four years earned a bachelor's in math and a master's in electrical engineering. Grad school took him to the opposite side of the country and Harvard University.

"Harvard was great, but that first year was tough coming from perfect weather in California," he says. "My first winter in Boston was the famous blizzard of '78. The storm was so bad that Harvard had to shut down. Here I was this California kid wearing flip flops. I figured I'd better get some real shoes."

A year later Jeff met his future wife, Sylvia, who was one year behind him at Harvard. With a PhD in applied physics in hand, Jeff worked at the Massachusetts Institute of Technology Lincoln Laboratory while Sylvia finished her PhD. Then a serious job hunt began.

"The job market in the early '80s was good," Jeff says. "Sylvia had lots of opportunities and I had nice offers as well."

The Tsaos picked Sandia and arrived in 1984. Jeff had a background in lasers, laser spectroscopy, and



IDEA GUY — Jeff Tsao was recognized with an Asian American Engineer of the Year award for his technical achievement, leadership, and public service. (Photo by Randy Montoya)

quantum electronics, and a strong interest in materials science. He joined a project involving pulsed laser annealing of silicon to look at the dynamics of ultra-fast crystal growth. He later switched to a study of crystal growth on a slower time scale using a then-emerging technique, molecular beam epitaxy.

"That was just wonderful," he says. "It's one example of why Sandia is such a great place to work. You can change fields, do different things in different phases of your career. I switched fields totally from laser-induced processes to something that was pure materials science."

Epitaxy is the arrangement of atoms on a substance in a crystalline fashion. Molecular beam epitaxy was new at the time and was being used to grow semiconductor structures layer by layer. "You put a single-crystal substrate into a high-vacuum chamber, and then evaporate very slowly another material onto the substrate. As the atoms or molecules of the vapor land on the substrate they arrange themselves in a crystalline way," Jeff says. "You can create devices with unprecedented control of their vertical layering. There are lots of applications. My interest was in the basic science of how epitaxy occurs."

Jeff wrote a book, *Materials Fundamentals of Molecular Beam Epitaxy*, and in the early 1990s became a level-one manager in the Microelectronics and Microsystems center. About seven years later, aware of the commercial potential of semiconductor materials and devices, he took an entrepreneurial leave of absence to work at a small Los Angeles startup company that made fiber optic communications components.

"I spent a year there," Jeff says. "I wanted to see how

the high-tech world functioned."

Back to Sandia, and research

He decided to return to Sandia in 2001, but not as a manager. "I realized I really liked research, and came back as a staff member," he says.

He joined the solid state lighting group as a researcher. "It was the beginning of a new field. While I was gone, Tom Picraux (retired), Jerry Simmons (1120), Mary Crawford (1120), and Eric Jones (retired) — with behind-the-scenes cheerleading from former EVP Al Romig and Margie Tatro (6100) — had been pushing solid-state lighting forward at Sandia," Jeff says. "At first nobody had a clue if it would take off. It was kind of a dream, but we could see the potential. Now nobody has any doubt it will pretty much replace every light bulb on

Earth. Sandia is recognized worldwide as a pioneer."

Jerry, senior manager of the Semiconductors and Optical Sciences department, says Jeff was one of the first people to push for a national initiative in solid-state lighting, coauthoring a white paper on the topic in 1999 with Jeff Nelson of Sandia and Fred Kish and Roland Haitz of Hewlett Packard. In subsequent years, Jeff was instrumental in helping identify and articulate to the community the major science and technology research challenges for solid-state lighting. Jerry says Jeff also did an "amazing" study on the consumption of light across several continents going back 300 years, showing that humanity tends to spend roughly 0.7 percent of its gross domestic product on lighting, regardless of its efficiency or standard of living.

"Jeff Tsao is one of the deepest thinkers and most creative individuals at the Labs," Jerry says. "He has an extensive understanding of solid state physics and the real nanoscale mechanisms of LED devices and lasers, and is always looking for new approaches. Jeff is a relentless producer of original ideas, which are often ahead of their time, and which propagate through the community to have broad eventual impact. It has been an extraordinary privilege to work with him over the years."

Jeff says his career has spanned a wide range of work, from in-the-lab experimental science, to management and entrepreneurship, to serving the larger research community through white papers, roadmaps, and forward-looking ideas.

"Most importantly, it's been full of wonderful friends, colleagues, and managers," he says. "And for that I am grateful."

Sandia Science & Technology Park sets open house

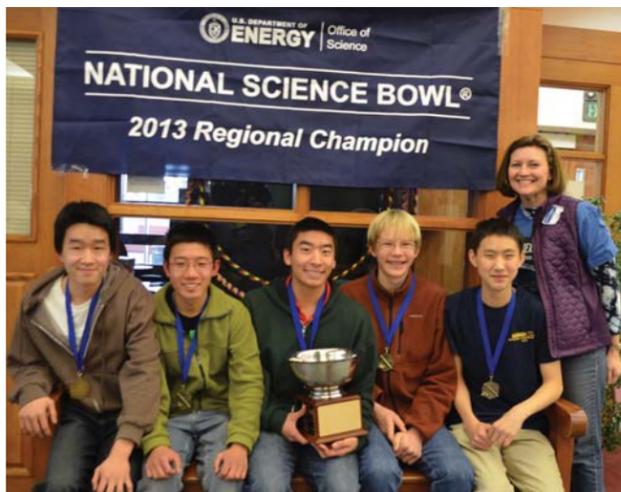


Representatives of companies and organizations in the Sandia Science & Technology Park (SS&TP) will be on hand Thursday, March 21, 11 a.m.-2 p.m., to talk about their businesses, technologies, and opportunities for collaboration.

The open house in the Steve Schiff Auditorium will feature Air Products, Analytical Solutions, Applied Technology Associates, EMCORE Corp., GAITS, Mazda Computing, MCAD Technologies, MOOG Inc., MOOG-CSA Engineering, National Museum of Nuclear Science & History, New Mexico School for the Blind and Visually Impaired, RED Inc. Communications, Raytheon Ktech, Sumitomo Electric Device Innovations USA, TEAM Technologies, and the QC Group.

SS&TP says the event will provide an opportunity to strengthen ongoing partnerships and initiate new ones. It is hosted by Sandia's Small Business Utilization Department and the SS&TP, and sponsored by the Sandia Science & Technology Park Development Corp. Light refreshments will be provided.

Los Alamos High School headed to DOE National Science Bowl



Students from Los Alamos High School will represent New Mexico at DOE's National Science Bowl in late April. The team, pictured here, took first place on Saturday, Feb. 16, at the New Mexico Regional High School Competition

after besting 28 teams representing 14 New Mexico high schools. Sandia coordinates the annual regional competition for DOE's Office of Science.

The fast-paced, 10-hour, "Jeopardy"-style competition requires students to answer questions related to astronomy, biology, chemistry, earth science, physics, math, trigonometry, and calculus.

The students, from left to right, are: Willie Zhao, Aaron Bao, Kevin Gao, Alex Swart, Alex Wang and their coach, Kathy Boerigter. The team will receive an all-expenses-paid trip to Washington, D.C., to compete against top teams from across the nation.

Albuquerque Academy came in second and La Cueva High School took the third place spot. DOE created the National Science Bowl in 1991 to encourage students to excel in math and science and pursue careers in related fields. More than 200,000 students have participated in the National Science Bowl in the 23 years since its inception.