A new twist on data storage

Sandia saving sensitive information securely in DNA

By Mollie Rappe

Z machine, just one of Sandia's research and test facilities, generates 100-200 gigabytes of data per year. That is a lot of digital data to inscribe on hard drives or beam up to the "cloud."

George Bachand (1132), a bioengineer at the Center for Integrated Nanotechnology, is exploring a better, more permanent method for encrypting and storing classified data: DNA. Compared to digital and analog information storage, DNA is more compact, more durable, and never becomes obsolete. Readable DNA was extracted from the 600,000-year-old remains of a horse found in the Yukon.

Seven miles of bookshelves

Tape- and disk-based data storage degrades and can become obsolete, requiring rewriting every decade or so. Cloud- or server-based storage requires a vast amount of electricity; in 2011 Google's server farms used enough electricity to power 200,000 US homes. Furthermore, old-school methods require lots and lots of space. IBM estimated that 1,000 gigabytes of information in book form would take up seven miles of bookshelves. In fact, Sandia recently completed a 15,000-square-foot building to store 35,000 boxes of inactive records and archival documents.

"Historically, the national laboratories and the US government have a lot of highly secure information that they need to store long-term. I see this as a potentially robust way of storing classified information in the future to preserve it for multiple generations," says George. "The

(Continued on page 4)

SANDIA BIOENGINEERS Marlene and George Bachand show off their new method for encrypting and storing sensitive information in DNA. Digital data storage degrades and can become obsolete and old-school books and paper require lots of space. (Photo by Lonnie Anderson)

Inside . . .

Exceptional service in the national interest

Sandia LabNews

Vol. 68, No. 13

July 8, 2016

Managed by Sandia Corporation for the National Nuclear Security Administration

A flash of insight: Research at Sandia's Lightning Lab

Sue Major Holmes

Sandia creates lightning in a lab to evaluate how anything from sensitive nuclear weapons components to entire buildings will hold up against the worst that nature might throw at them.

"Sandia's primary mission is to assure an 'always/never' operating condition for nuclear weapons," says Electrical Sciences Senior Manager Larry Schneider (1350). "They must work when authorized and never function otherwise. Direct strike lightning is a threat in the 'never' scenario."

Researchers at the Lightning Simulator laboratory build upon the fundamental understanding of the physics involved in lightning to ensure the incredible energy it releases cannot reach sensitive areas of a weapon, Larry says. Their work includes developing complex theories and sophisticated computer modeling, "but ultimately, due to the complexity of the physics, it's the testing that leads to confidence that the weapons remain safe even after a devastating event," he says.

RESEARCHER LEONARD MARTINEZ makes an adjustment at the Lightning Simulator lab as part of a test series to further knowledge of lightning protection systems by looking at how lightning currents flow through rebar lattice structures. Sandia's specialized lightning lab evaluates how everything from sensitive nuclear weapons components to entire buildings will hold up against the worst that nature can offer. (Photo by Randy Montoya)

Supporting Stockpile Stewardship

The lab's electromagnetic qualification experiments support stockpile stewardship, helping ensure that small components, subsystems, and nuclear weapon systems meet requirements, whether lightning directly strikes the weapon or the missile or aircraft that carries it, or whether lightning strikes nearby and generates electromagnetic fields, says Leonard Martinez of Electrical Sciences & Experiments Dept. 1353.

Lightning Simulator experiments are part of a battery of tests Sandia conducts across a broad range of facilities to ensure that stockpile nuclear weapons are safe, secure, and effective.

Electrical Sciences & Experiments Manager Steve Glover says tests are a critical part of "validation and verification that the designs and manufacturing are correct and these systems are protected the way we intend."

Sandia has performed lightning tests since the 1970s. Today, the focus is on improving understanding of the science behind lightning and the ways it can couple into systems, Leonard says.

Understanding lightning protection systems

For example in one project, the Lightning Simulator is performing a series of tests to further researchers' knowledge of lightning protection systems by looking at how lightning currents flow through rebar lattice structures and what electromagnetic forces are generated on lightning protection bond wire assemblies subjected to lightning currents of up to 200,000 amperes, Leonard says. The tests span the simulator's range of currents from 30,000 to 200,000 amperes. An ampere is a measurement of the flow of current in an electrical conductor.

Most of the tests are conducted on prefabricated samples of reinforced concrete walls, but researchers also measure currents at several locations in the lattice, without the

(Continued on page 5)

That's that

And now, for something completely different, here's some good news: For the first time in almost 20 years, a commercial nuclear reactor is coming online in the US, this one with enough oomph to power 650,000 homes.

The Watts Bar Unit 2 reactor in Tennessee – it's part of the TVA Watts Bar Nuclear Generating Station – doesn't break any new technical ground to speak of, but that's okay. It's kind of like the story about the talking horse: It's not so much what she has to say as that she can say anything at all.

Likewise, the Watts Bar Unit 2 reactor may be based on designs that date back to the 1970s – that's when planning on this project started – but the very fact that we're bringing any new reactor online is reason enough for quiet celebration.

Construction on Unit 2 began in the 1970s, but was halted in the 1980s and not resumed until 2007. Why the delay? Conventional wisdom has it that the Three Mile Island accident "killed" the industry. It was certainly a factor, but the reality is more complicated. There was an over-commitment for new reactors in the 1970s; cancellations were on the upswing before anyone ever heard of Three Mile Island or The China Syndrome. Cost overruns were monumental. Plants that were budgeted to cost $1 billion ended up costing four times that amount. This new source of energy, which was supposed to be "too cheap to meter!", proved to be expensive.

Then Three Mile Island happened, exposing deep problems in the industry and galvanizing activist opposition. The accident's impact on public health is still subject of debate and disagreement, but perceptions are important and the accident became the poster child for everything wrong with nuclear power. Chernobyl, a decade later, was unambiguously a public health and environmental disaster of the first order. Whatever promise nuclear power seemed to offer was offset, in the public mind at least, by unacceptable risks to safety, health, and the environment.

Anyhow, for a lot of reasons nuclear power – which accounts for about 20 percent of US energy capacity even though almost no new reactors have come online in decades – went into limbo. But what with concerns over CO2 and its possible impact on climate change, the demand for green(er) energy alternatives has been on the upswing. Solar power, wind, tide, geothermal – all have their advocates and all have their place. Indeed, Sandia is involved in researching all of these technologies. But for big base load-scale energy generation right now, today, nuclear energy strikes me as hard to beat. It has a proven track record; it emits zero CO2; and an innovative new generation of reactors is safer and cleaner than ever.

Granted, the new Watts Bar reactor is still old-school, technically speaking, but the fact that it has come online quietly and with little public opposition marks a real turning point in how the public thinks about this energy source. The long-standing debate about the pros and cons of nuclear reminds me of what Winston Churchill said about democracy: "It is the worst form of government ever devised . . . except for all the others."

* * *

In honor of summer, here's a Shark Week story for you: A few years back my wife, Rebecca, and I took a vacation to the Florida Keys, one of my very favorite places and the only locale in the continental US where you can practically drive to a coral reef to snorkel. So there we are, several miles offshore at Looe Key, the most popular snorkel site in the Middle Keys. We're in 80-degree water swimming among the wondrous panoply of fish and the otherworldly formations. I have an underwater camera and am snapping away at everything. Suddenly (prompt Jaws theme here) a shark that looks about 6 feet long (and was probably more like 3) swims right under Rebecca. It's clear to me she hasn't seen the fish, but I have a great view and get a couple of very striking pictures. As the shark swims away, I signal Rebecca to meet me at the surface. "What's going on?" she wonders. I exclaim, "I just got this great picture of a shark. Yeah, a shark! It wasn't more than two feet from you!!!" Rebecca isn't nearly as excited as I am; in the circumstances, she doesn't think getting "great" photos should have been my top priority.

And that's how my Shark Week turned into a week in the dog house in Marathon, Florida.

See you next time.

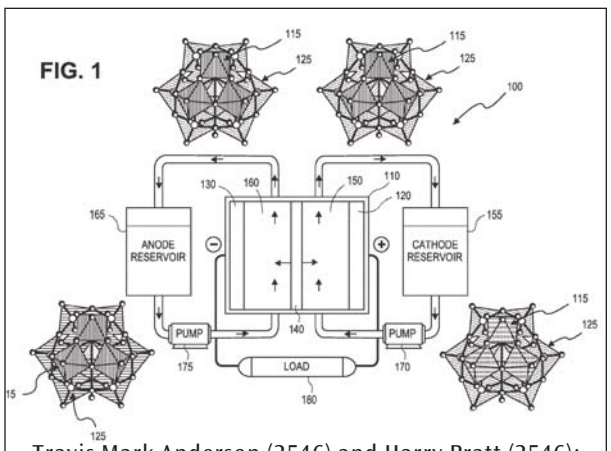
– Bill Murphy (MS 1468, 505-845-0845, wtmurph@sandia.gov)

Recent patents

Note: Patents listed here include the names of active and retired Sandians only; former Sandians and non-Sandia inventors are not included. Following the listing for each patent is a patent number, which is searchable at the US Patent and Trademark Office website (www.uspto.gov).

US Patent Office circa 1889

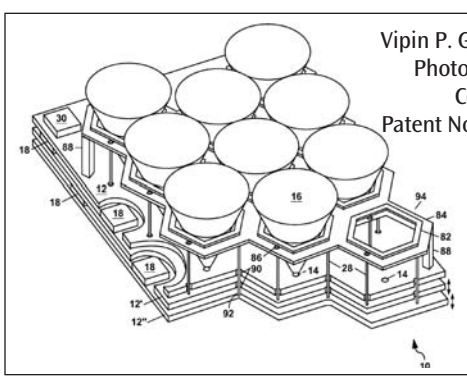
Darren W. Branch (1714), Roy H. Olsson (1719), and Christopher Nordquist (1764): Programmable Electroacoustic Filter Apparatus and Method for its Manufacture. Patent No. 9,276,557.



Travis Mark Anderson (2546) and Harry Pratt (2546): Polyoxometalate Flow Battery. Patent No. 9,287,578.

Hayden James Evans McGuinness (1725), Peter Schwindt (1728), Grant Biedermann (1728), Yuan-Yu Jau (1728), and David R. Wheeler (5964): Light-Pulse Atom Interferometric Device. Patent No. 9,291,508.

Kent B. Pfeifer (1714), Adrian L. Casias (1833), and Alex L. Robinson (2632): PC Board Mount Corrosion Sensitive Sensor. Patent No. 9,291,543.



Vipin P. Gupta (6124): Photovoltaic Solar Concentrator. Patent No. 9,287,430.

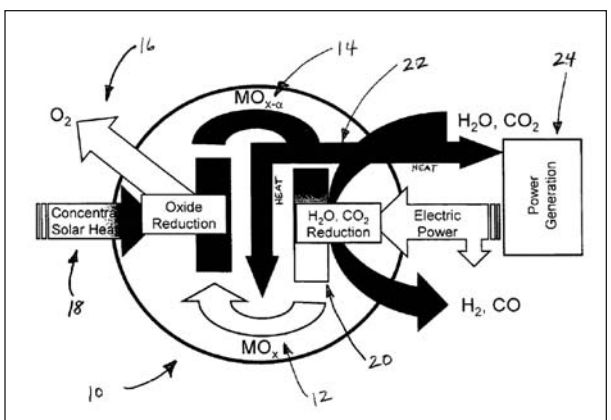
Thomas Edwin Beechem III (1124), Taisuke Ohta (1132), Paul Davids, (1765), David W. Peters (1765), and Stephen W. Howell (1765): Sub-Wavelength Antenna Enhanced Bilayer Graphene Tunable Photodetector. Patent No. 9,293,627.

Vipin P. Gupta (6124): Asphaltene Based Photovoltaic Devices. Patent No. 9,293,266.

William A. Stygar (1651): High-Voltage, Low-Inductance Gas Switch. Patent No. 9,294,085.

Jonathan Crussell (8962), Ken Chiang (8965), Levi Lloyd (8965), and David Jakob Fritz (8966): Malware Detection and Analysis. Patent No. 9,294,486.

Eric A. Shaner (1118) and Gregory Conrad Dyer (5785): Two-path Plasmonic Interferometer with Integrated Detector. Patent No. 9,297,638.



James E. Miller (1815): Hybrid Metal Oxide Cycle Water Splitting. Patent No. 9,279,188.

Exceptional service in the national interest

SandiaLabNews

Sandia National Laboratories

http://www.sandia.gov/LabNews

Albuquerque, New Mexico 87185-1468
Livermore, California 94550-0969
Tonopah, Nevada • Nevada National Security Site
Amarillo, Texas • Carlsbad, New Mexico • Washington, D.C.

Sandia National Laboratories is a multiprogram laboratory operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corp., for the US Department of Energy's National Nuclear Security Administration.

Bill Murphy, Editor 505/845-0845
Randy Montoya, Photographer 505/844-5605
Patti Koning, California site contact 925/294-4911
Michael Lanigan, Production 505/844-2297

Contributors: Michelle Fleming (Ads, Milepost photos, 844-4902), Neal Singer (845-7078), Stephanie Holinka (284-9227), Darrick Hurst (844-8009), Heather Clark (844-3511), Sue Holmes (844-6362), Nancy Salem (844-2739), Valerie Larkin (284-7879), Lindsey Kibler (844-7988), Tim Deshler (844-2502), Rebecca Brock (844-7772), Mollie Rappe (844-8220), Michael Padilla (925-294-2447), Valerie Smith, manager (844-6167)

Lab News fax 505/844-0645
Classified ads 505/844-4902

Published on alternate Fridays by Internal & Digital Communications Dept. 3651, MS 1468

LOCKHEED MARTIN

Lab News Reader Service

The *Sandia Lab News* is distributed in-house to all Sandia employees and on-site contractors and mailed to all Sandia retirees. It is also mailed to individuals in industry, government, academia, nonprofit organizations, media, and private life who request it.

Retirees (only):

To notify of changes in address, contact Benefits Dept. 3332, Customer Service, at 505-844-4237, or Mail Stop 1021, Sandia National Laboratories, Albuquerque, NM 87185-1021.

Others:

To receive the *Lab News* or to change the address (except retirees), contact Michelle Fleming, Media Relations and Communications Dept. 3651, 505-844-4902, email meflemi@ sandia.gov, or Mail Stop 0148, Sandia National Laboratories, Albuquerque, NM 87185-0165.

Employees:

To address concerns regarding delivery of the *Lab News* to your facility, call Mail Services Team 10268-4, at 844-3796. At Sandia/California contact the Mail Room at 925-294-2427.

Web users:

The *Lab News* is available on online at www.sandia.gov/LabNews.

LIVERMORE, PHONE HOME

New telephone system installed covers nearly 3,000 lines

New Sandia/California phone system works over network instead of traditional lines

By Michael Padilla

In 1988 Sandia/California made history by breaking away from the telephone line tied to the city of Livermore and creating its own system. Once again the site has made history by switching its 28-year-old Lucent Technologies 5ESS telephone system to an IP telephone system.

Acting Chief Information Officer and VP for Information Technology Services Div. 9000 Len Napolitano, who oversaw the nearly two-year project, says the new system will serve the site well into the future.

"Sandia's current phone system in California was reaching its end of life and there was a critical need to update the system," Len says. "The system we have chosen allows us to leverage other Sandia services and offers other benefits."

SWITCH ON – Sandia/California recently made history by switching its 28-year-old Lucent Technologies 5ESS telephone system to an IP telephone system. Joining in the switch were, from left to right, David White (9300), Kelly Rogers (9330), Heidi Ammerlahn (8900), Len Napolitano (9000), and Tim Berg (8940). (Photo by Loren Stacks)

The new Voice over Internet Protocol (VoIP) system will position the site to use other Sandia IT Unified Communication services. The new phones also offer multiple ring tones, larger contact capacity, easier headset integration, multi-lines, and color LCD displays.

Marcia Jacobs (8940), who directed the project, says the 28-year-old 5ESS telephone switch was becoming difficult to support in a timely manner, especially as parts became obsolete.

"The telephone industry has moved most of its development resources toward VoIP and wireless and is providing only minimal support for older phone systems," she says.

No interruption

One of the project team's main goals was to make the conversion as seamless as possible without any interruptions to members of the workforce.

Most of the conversions took place after hours, says Marcia. Access to locked offices and various areas was coordinated with the owning personnel and the Security ProForce. A formal communications plan addressed each area prior to a conversion. Marcia and her team met with organizations, primarily the administrative staff, to discuss and coordinate the migration process for their areas.

One of the most challenging changeovers was converting the entire California management and administrative staff at one time. Preparation for this migration took several weeks.

"After our team mastered the telephone conversion process, we converted California 24x7 operations and groups at the end of the project so we could specifically focus on meeting the needs of their business with minimal telephone disruption," Marcia says. "In a few buildings that lack a fiber infrastructure we were unable to provide a new IP telephone. We converted their ISDN telephones to the new telephone system as ISDN service."

Another challenge for the team was cleaning up 28 years' worth of circuit data from the database and 5ESS telephone system. More than 400 telephone circuits were removed that were not in use. Conversions of secure telephones were coordinated with the owning organizations. These conversions required significant testing prior to migrating these circuits to a new system.

WE CAN HEAR YOU NOW – Acting Chief Information Officer and VP for Information Technology Services Div. 9000 Len Napolitano and Kelly Rogers (9330) demonstrate an old form of communication. Photo by Loren Stacks)

Sandia Exceptional service in the national interest CaliforniaNews

Marcia says success of the project was due to close coordination and dedication from various groups across the site including the entire Communications and Network Systems department; Sandia's Security ProForce and others in organization 8510; the site's administrative staff; management and personnel from organizations 9000, 9330, and 8940; the CIO office and CIO communications team; and California Ergonomics.

Today the team is focusing on providing reliable and consistent telephone service and proactively reducing unplanned outages, says Marcia. The site is now challenged, relying on many different network and hardware components rather than the 5ESS telephone switch or any previous telephone system. "Amazingly the 5ESS only had one outage in 28 years," says Marcia.

She cautions that it is critical that personnel do not move or connect their own telephones. Otherwise, emergency responders will not have current locations. In an emergency, if there is not a telephone nearby, call 925-294-2222 (California) on a cellular phone.

Stockpile stewardship and the national labs

By Sue Major Holmes

Sandia's No. 1 job is ensuring the day-to-day safety, security, and effectiveness of the nation's nuclear weapons stockpile, work that culminates in an annual assessment letter from Sandia's president that ultimately lands on the desk of the president of the United States, the Labs' executive VP for National Security Programs told a June 21 symposium of the Strategic Deterrent Coalition.

"The letter is really just a derivative product of a day-in, day-out set of assessments, analyses, experimental data sampling, and data gathering activities that involve hundreds of staff at our Laboratories," Steve Rottler said.

He was part of the symposium's opening panel on "National Laboratories and Stockpile Challenges." Steve and the other panelists — Robert Webster, principal associate director for Weapons Programs at Los Alamos National Laboratory, and Charles Verdon, principal associate director of Weapons and Complex Integration at Lawrence Livermore National Laboratory — outlined the roles their labs play in stockpile stewardship and how they do the job.

Over the decades the federal government has made significant investments in Sandia as the nation's nuclear weapons engineering laboratory, in Los Alamos and Lawrence Livermore as the nuclear weapons design labs, and in weapons production agencies, Steve said. For Sandia, that investment means a research base, the people who do the work, and a host of facilities they use in their research.

Sandia is responsible for components such as neutron generators, and works with the other NNSA laboratories to develop militarily effective weapons, Steve said. Sandia, in partnership with its sister labs, also plays a key role in delivering engineered and integrated nuclear weapons systems, and has a limited production mission for neutron generators and trusted, radiation-hardened microelectronics, he said.

Steve and his counterparts at the design labs said multiple nuclear weapons-related programs moving forward simultaneously make for a very busy time.

Workload heaviest in decades

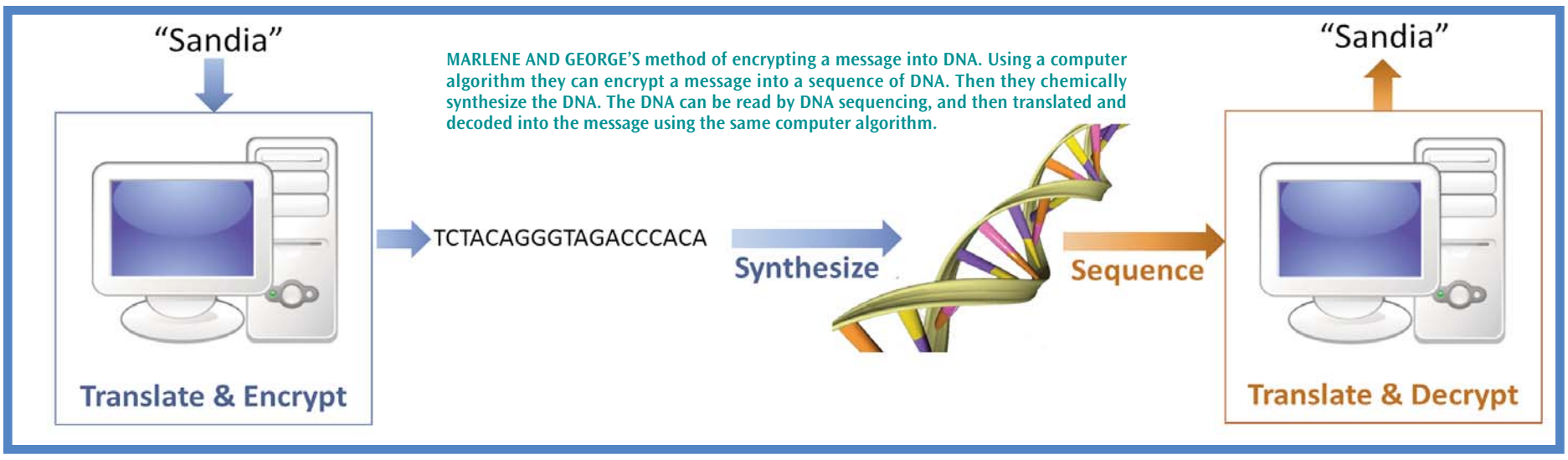
Sandia has a workload "unlike anything in the nuclear weapons program we've experienced in close to three decades," Steve said. He listed five major programs: the B61-12 Life Extension Program (LEP) and the W88 Alteration 370, which are the most mature; the W80-4 LEP, in the early stages of planning and developing budgets; modernization of the Mk21 Fuze; and designing a new Mobile Guardian Transporter to replace the current system for moving weapons around the country.

A strong science and engineering foundation allows Sandia to carry out its core nuclear weapons mission, but its other missions rest on that foundation as well, Steve said. "We have learned over the decades how to take those capabilities and use them in ways that allow us to do equally unique and impactful things in the domain of national security for other governmental agencies," he said.

An intimate relationship exists between the nuclear weapons mission and Sandia's other six mission areas: nonproliferation of nuclear weapons and materials; addressing threats in cyberspace; supporting the military; reducing chemical and biological dangers around the globe; helping create a secure energy future for the nation; and developing sensors and detectors in space to protect national security, Steve said.

While other missions couldn't be done without the core mission, "the reverse is also equally true, that there are aspects of those other missions that make it possible for us to carry out our core mission," Steve said.

For example, he said Sandia had no radar research and development programs specifically in nuclear weapons for nearly 20 years. However, Sandia sustained its ability to design and develop radar because of its continuing work on Synthetic Aperture Radar, a technology to vastly improve radar images. Thus, he said, it was ready to support radar for the W76-1 LEP when that program began in the last decade.



MARLENE AND GEORGE'S method of encrypting a message into DNA. Using a computer algorithm they can encrypt a message into a sequence of DNA. Then they chemically synthesize the DNA. The DNA can be read by DNA sequencing, and then translated and decoded into the message using the same computer algorithm.

DNA data storage

(Continued from page 1)

key is how do you go from text to DNA and do that in a way that is safe and secure."

George was inspired by the recording of all of Shakespeare's sonnets into 2.5 million base pairs of DNA — about half the genome of the tiny E. coli bacterium. Using this method, the group at the European Bioinformatics Institute could theoretically store 2.2 petabytes of information — 200 times the printed material in the Library of Congress — in one gram of DNA.

Marlene Bachand (1132), a biological engineer at Sandia and George's wife, adds, "We are taking advantage of a biological component, DNA, and using its unique ability to encode huge amounts of data in an extremely small volume to develop DNA constructs that can be used to transmit and store vast amounts of encrypted data for security purposes."

The Bachands' project, funded by Sandia's Laboratory Directed Research & Development program, has successfully moved from the drawing board to letterhead. Using a practically unbreakable encryption key, the team has encoded an abridged version of the famous Truman letter establishing Sandia into DNA. They then made the DNA, spotted it onto Sandia letterhead, and mailed it — along with a conventional letter — around the country. After the letter's cross-country trip, the team was able to extract the DNA out of the paper, amplify and sequence the DNA, and decode the message in about 24 hours at a cost of about $45.

Text to DNA and back again

To achieve this proof-of-principle, the first step was to develop the software to generate the encryption key and encrypt text into a DNA sequence. Andrew Gomez worked on this while he was an intern at Sandia; he is now at Senior Scientific, a nanomedicine company at the University of New Mexico's Science and Technology Park.

DNA is made up of four bases, commonly referred to by their one-letter abbreviations: A, C, G, and T. Using a three-base code, exactly how living organisms store their information, 64 distinct characters, letters, spaces, and punctuation, can be encoded, with room for redundancy.

For example, spaces make up on average 15 to 20 percent of the characters in a text document, an encryption key could specify that TAG, TAA, and TGA each code for "space" while GAA and CTC could code for "E". This would reduce the amount of repetition — technically challenging for making and reading DNA — and make brute-force hacking more difficult.

The team's first test was to encode a 180-character message, about the size of a tweet. Encoding the message into 550 bases was easy; actually making the DNA was hard.

"Our initial approach was very expensive, very time-consuming, and didn't work," says George with a chuckle. However, "there's a new technology that's come out and made the ability to take synthetic DNA, what are called gene blocks, and stitch them together into these artificial chromosomes. These changes have just happened within the last few years, which has made it pretty extraordinary. Now it is possible to readily make these gene blocks right on the bench top and it can be done in large, production-scale pretty quickly."

Identifying potential national security applications

Since successfully encoding, making, reading, and decoding the 180-character message and the 700-character Truman letter, George and Marlene are now working on even longer test sequences. However, what the Bachands really want to do is move beyond tests and apply their technique to national security problems.

"We have achieved the proof-of-principle. Yes, it is possible. Now the big challenge for us is identifying the potential applications," says George. "Using DNA to store information is pretty cool, it's science-fiction-y, but the real question is it really good for anything? Can it really supplant any of the current technology and where we're headed in the future?"

Two possible applications the team has identified are storing historical classified documents and barcoding/watermarking electromechanical components, such as computer chips made in MESA, Sandia's DoD-certified fabrication facility, prior to storage.

George imagines encoding each component's history — when it was manufactured, the lot number, starting material, even the results of reliability tests — into DNA and spotting it onto the actual chip. Instead of having to find the serial number and look up that metadata in a digital or paper-based database, future engineers could swab the chip itself, sequence the DNA, and get that information in a practically tamper-proof manner.

Recoverable for 100s of years

To test the feasibility, Marlene spotted lab equipment with a test message, and was able recover and decode the message, even after months of daily use and routine cleaning. DNA spotted onto electronic components and stored in cool, dark environments could be recoverable for hundreds of years.

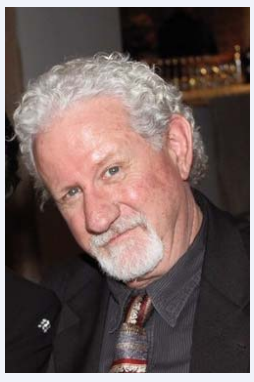
Another, more straightforward application for the Bachands' DNA storage method would be for historical or rarely accessed classified documents. DNA requires much less maintenance than disk- or tape-based storage and doesn't need lots of electricity or tons of space like cloud- or paper-based storage. But conversion of paper documents into DNA requires the "cumbersome" process of scanning, encrypting, then synthesizing the DNA, admits George. Making the DNA is the most expensive part of the process, but the cost has decreased substantially over the past few years and should continue to drop.

"I hope this project progresses and expands the biological scope and nature of projects here at Sandia. I believe the field of biomimicry has no boundaries. Given all of the issues with broken encryption and data breaches, this technology could potentially provide a path to address these timely and ever-increasing security problems," says Marlene.

Employee death

Quick with a joke and kind of heart, Dave Herman always thought of others

"Hey, T-Bone!" . . . "Howdy, Partner!" . . . "Whattya say, Pork Chop?" When Dave Herman showed up at work his greetings were warm, personal, and fun. His sheer presence, punctuated by his seeming endless supply of jokes and riddles, was enough to lighten every work day, recalls former manager Rudy Jungst, now retired.



DAVE HERMAN

Dave, who passed away at age 61 on June 23, was hired as a Sandia employee in the Power Sources Technology Group (PSTG) in 2013, but had worked as a contractor with the group for the previous 10 years.

Rudy recalls that as a valued team member, Dave had a strong commitment to customer service and to producing high-quality power source components.

"He was always willing to spend extra hours to get the job done right," Rudy says.

Eric Detlefs (2548), Dave's most recent manager, only worked with him for a brief time, but plenty long enough to appreciate Dave's special value to the team.

"Soon after joining the PSTG, I found out that Dave was the subject matter expert for many key processes for our in-house thermal battery prototyping and production team and was a true resource for the entire group. He had a very broad and deep knowledge of thermal battery production. His attitude, professionalism, and friendship will be missed."

Colleague Lou Malizia (2548-1) says he was "always impressed with Dave's knowledge and skills and was constantly amazed at his joke-telling abilities. He could always rattle off two or three in a row that would keep you in stitches."

Dave was tirelessly helpful and willing to share his knowledge, recalls Anna Atencio (2548), who worked with him for a short time. "Dave was very smart and knowledgeable on all dry room processes," Anna says, adding that, "I didn't know him for long, but I learned that he had a passion for his motorcycle, his guitars, and his dogs."

Dave presented something of a paradox, recalls Joe Garcia (2548-1), who worked with him for 13 years. Dave was a bit of a loner, Joe says, but always ready with a joke and as generous as the day is long. "He would go out of his way to stop by and pick me up for work. . . . I often asked for his help and he was always there. I will greatly miss 'me old Irish friend.'"

"Giving came naturally for Dave," says colleague Patrick Benavidez (2548-1), "even if it was just leaving candy in coworkers' offices or a bowl of popcorn in my office. And he always had a neatly folded dollar bill in his pocket to give to a person in need."

In a work association that stretched back 13 years, Patrick quickly learned that Dave was "so gifted with computers that I would turn to him for help. He never complained about helping or about being distracted from his own work. . . . I will always be reminded of him at 12:34 p.m., which was his favorite time of day."

Jim White's first impression of Dave struck a chord. "I met him in 2008 when I was hired into Power Sources," Jim (4825) says. "We shared an office and on the first day of work Dave said to me, 'Greetings, Earthling.' From then on I knew he was a jokester. . . . Dave liked to tell a good joke or have a riddle to figure out. We shared an interest in motorcycles and vintage automobiles. I last emailed him about a month and a half ago and we shared a laugh and wished each other well."

When colleagues remember Dave, the same theme keeps recurring. As Gail Baca puts it: "Dave was a terrific individual who loved to put a smile on your face with his daily jokes. He always thought of others and would quite often leave treats on your desk as his token of appreciation. He will truly be missed here in the PSTG."

Dave is survived by his wife of 19 years, Maria Isabel Garcia; a brother and sister; a niece and nephews; and in-laws. An Air Force veteran, Dave was buried at the Santa Fe National Cemetery.

— Bill Murphy

Power investing

DOE funding moves two Sandia energy projects closer to the marketplace

By Nancy Salem

Two Sandia technologies are among 54 energy projects that will receive nearly $16 million from DOE to help bring them to market. The projects involve 12 national labs and 52 private-sector partners.

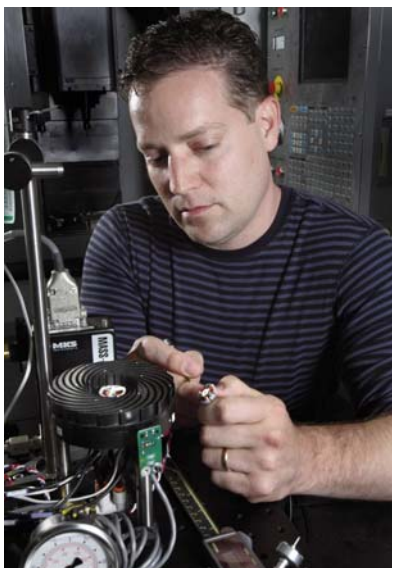
Funding comes through the Technology Commercialization Fund (TCF) administered by DOE's Office of Technology Transitions, which works to expand the commercial impact of the department's portfolio of research, development, demonstration, and deployment activities. In February, the office called for TCF funding proposals from the DOE national labs and received 104 applications in two topic areas:

• Projects for which additional technology maturation is needed to attract a private partner; and

• Cooperative development projects between a lab and industry partner(s), designed to bolster the commercial application of a lab-developed technology.

All projects selected will receive an equal amount of non-federal money to match the federal investment.

"Deploying new clean energy technologies is an essential part of our nation's effort to lead in the 21st century economy and in the fight against climate change," says Lynn Orr, DOE's undersecretary for Science and Energy. "The funds will help to accelerate the commercialization of cutting-edge energy technologies developed in our national labs, making them more widely available to American consumers and businesses."



CHIP COOLING — Jeff Koplow (8366) adjusts a prototype of his Air Bearing Heat Exchanger invention. The technology, known as the Sandia Cooler, significantly reduces the energy needed to cool the processor chips in data centers and large-scale computing environments. (Photo by Dino Vournas)

Mary Monson, senior manager of Industry Partnerships Dept. 1930, says Sandia looks forward to working with the private sector to commercialize technology. "Tech transfer supports Sandia's national security mission and strengthens the economy," she says. "The Technology Commercialization Fund is an exciting program that will bring national laboratory expertise to industry and build the energy sector of the economy."

Cooling processor chips

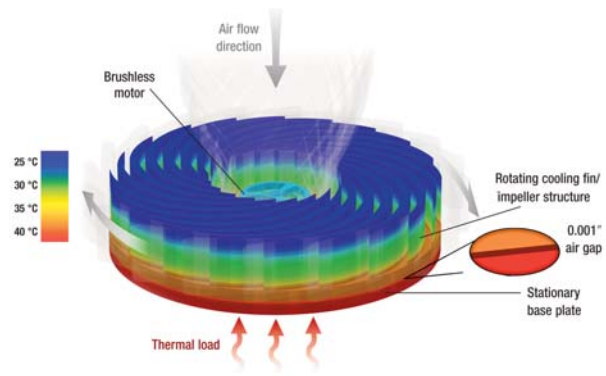
At Sandia, efforts to commercialize the Sandia Cooler will receive $168,000 in federal funding; its partner is Wakefield-Vette Thermal Solutions of Pelham, New Hampshire. And High Temperature BA-BZT-BT Capacitors was awarded $50,000 from the fund; its partner is TPL Inc. of Albuquerque.

The Sandia Cooler reduces the energy needed to cool processor chips in data centers and other large-scale computing environments.

In a conventional computer CPU application, the Cooler efficiently transfers heat across a narrow air gap from a stationary base to a rotating finned structure overcoming the stagnant insulating air "blanket" inherent in traditional stationary finned cooling structures.

The Cooler offers benefits in other applications where thermal management and energy efficiency are important, such as home appliances and heating, ventilation, and air-conditioning systems. The Sandia Cooler architecture can eliminate several additional drawbacks of conventional air-cooled heat exchanger technology, such as fouling and excessive noise.

The technology also can be competitive in cost, simplicity, and durability. It won an R&D 100 Award in 2012. Initial work on the Cooler technology was funded by the Laboratory Directed Research and Development program.



IN THIS DIAGRAM of the Sandia Cooler, heat is transferred to the rotating cooling fins. Rotation of the cooling fins eliminates the thermal bottleneck typically associated with a conventional CPU cooler. (Diagram courtesy of Jeff Koplow)

High-temp power electronics

The BA-BZT-BT capacitors project evolved from Sandia's longstanding work to develop silicon carbide- and gallium nitride-based power electronics that can operate at high temperatures, from 250 to 400 degrees Celsius (about 480 to 750 degrees Fahrenheit). These wide bandgap materials allow electronic systems to operate in harsh environments. To date, there hasn't been as much research into the complementary passive components of the electronic circuitry.

The Sandia team behind the BA-BZT-BT dielectrics, working with the DOE Office of Electricity, is developing capacitors that can operate in such extreme temperatures. They have shown that common and relatively inexpensive elements can be used to make capacitors with promising performance characteristics. One targeted use is in power conversion systems for grid-tied energy storage. The system would be highly efficient and require no cooling to make the electronics function properly, ultimately leading to better performance and cost savings.

DOE's national labs have supported critical research and development leading to many technologies in the marketplace today, including the batteries powering electric vehicles, the foundation of internet servers, and the optical digital recording technology behind DVDs.

"The great work at the national labs and across DOE's program make the department one of the largest supporters of technology transfer within the federal government," says Jetta Wong, director of the Office of Technology Transitions. "These TCF selections will further strengthen those efforts across a broad spectrum of energy technologies and advance DOE's important mission to transition technologies to the market."

Lightning lab

(Continued from page 1)

surrounding concrete, to better understand current distribution in realistic configurations, Leonard says. They compare the measured current distribution to the results of their electromagnetic models to validate the models, and conduct electromagnetic analysis to calculate expected forces on lightning protection bond wire assemblies, he says.

High-speed photometric cameras capture movements or deflections in the assemblies for additional analysis.

Guiding of computer models

Experiments to understand the physics of lightning effects enable Sandia's Electromagnetic Theory department create better electrical and electromagnetic computer models to help predict how a nuclear weapon system will react if hit by lightning.

LIGHTNING TEST — In 1982, Sandia's Lightning Simulator performed a night test for the Naval Air Systems Command, which wanted to know how a lightning strike would affect sensitive computer electronics on its aircraft. An F14 was subjected to a charge that entered through the nose and exited via the wing tip. (Photo by John Cowie and Billy Pierce)

"We try to understand how much energy, in terms of voltage and current, penetrates a weapon due to direct strike lightning," says the department's Roy Jorgenson, a computer scientist specializing in electromagnetics.

Lightning Simulator experiments, in combination with smaller-scale validation experiments, guide the creation of analytical and empirical models, he says. The group uses a combination of analytical techniques and codes within a suite of codes called Ramses.

"The Lightning Simulator is the tie between the actual lightning event in nature and small-scale experiments," Roy says.

Lightning is an electrical current, like a massive jolt of static electricity. Thunderclouds have electrical charges — lighter, positively charged particles on top and heavier, negatively charged particles on the bottom. When a cloud's positive and negative charges are large enough, they try to neutralize by reaching each other, causing a huge spark — lightning — between them. Most lightning occurs within clouds but negative charges also are attracted to positive charges on the ground, concentrated around taller objects such as trees. When those charges connect, lightning hits the ground.

The eye sees a single bolt, but a lightning flash consists of many return strokes, moving too fast to see separately. A cloud partially discharges its energy when the first stroke hits. The remaining energy continues to flow in residual or continuing current and may lead to a return stroke.

The lab creates a lightning pulse by discharging high-voltage capacitor banks known as Marx generators, housed in two high-voltage tanks filled with insulating oil. The simulator's charge console controls when lightning pulses from the generators are released. Each generator puts out a return stroke, and a continuing current source can be injected between pulses, much like natural lightning.

The simulator can generate strikes up to a maximum peak current of 200,000 amperes for a single stroke, 100,000 amperes for a subsequent stroke, and several hundred amperes of continuing current for hundreds of milliseconds. In direct lightning tests, the simulator is connected to an object or arcs to it to simulate a lightning strike. In indirect tests, the lightning current is close by but doesn't actually strike the object. This lets researchers study how magnetic fields generated by the nearby strike affect test objects.

Mission control

Operators charge and fire the machine from a control room, sending a signal throughout the simulator to fire in sequence. Data flows into a screen room, so-called because its walls screen out electromagnetic waves that would interfere with diagnostic recorders. Fiber optic transmitters send information from the experiment into the screen room's fiber optic receiver, where it's converted into an analog signal that can be viewed on an oscilloscope for analysis.

The lab does 200 to 300 tests a year, and operators can fire the machine several times a day, Leonard says.

Other agencies call on Sandia's expertise in high-voltage science.

The Mine Safety and Health Administration (MSHA) asked for help in determining the cause of a Jan. 2, 2006, explosion in West Virginia's Sago Mine that killed 12 miners. MSHA asked Sandia to study whether energy from a lightning strike could travel underground to ignite an explosive mixture of methane gas trapped in a sealed section of the coal mine. A Sandia team spent 10 days at the site, and characterized a mechanism that accident investigators hadn't previously considered — that current from a surface lightning strike can generate electromagnetic fields that spread through the earth. The findings were part of MSHA's investigation report to Congress.

In 1982, the simulator did its largest test ever when the Naval Air Systems Command wanted to know how a lightning strike would affect the sensitive computer electronics of an aircraft. The lab subjected an F-14A parked at the rear of the lab to an 80,000-ampere pulse that entered through the nose and exited via the wing tip. The charge, lasting less than a second, coursed through a series of cables back to the lab to be measured. The simulator building has since expanded into where the plane was parked, so such a test is no longer possible, Leonard says.

SUPER COOL

Balloons help gather Arctic data on supercooled liquid water

By Neal Singer

Supercooled liquid water sounds smooth enough to be served at Starbucks, but instead, it hangs out like a bad boy in Earth's atmosphere, unpredictably freezing on airplane wings and hampering simulations of climate theorists.

To learn more about this unusual state of matter, atmospheric scientist Darielle Dexheimer (6913) and colleagues have organized an expedition to fly huge tethered balloons in darkest Alaska this winter, where temperatures descend to 40 below and it's dark as a dungeon for all but a few hours of the day.

A CASCADE OF ICE breaks loose from tether lines as Darielle Dexheimer gathers in an instrumented balloon at the ARM research station at Oliktok Point, Alaska. The balloon is about 25 feet above Darielle's head and the lines are completely iced over. (Photo courtesy of Darielle Dexheimer)

"We'll start in November and see how it goes," she says. The team has been collecting data from tethered balloons in Alaska since 2015, but has not yet operated into the cold season beyond October.

One of the northernmost points in the US

The idea is to wrest more data about the presence and behavior of supercooled liquid water where it is most plentiful and at a location most crucial to climate modelers: at Oliktok Point at the tip of oilfields of Prudhoe Bay, one of the northernmost points of the United States.

"Supercooled liquid water freezes on impact with aircraft and presents a hazard to aviation," says Darielle. "The potential for aircraft icing is difficult to model because it's typically reported in PIREPs [pilot reports] that are subjective and vary in space and time, and from aircraft that are typically attempting to avoid icing. Acquiring in situ icing data in clouds, through use of tethered balloons, eliminates many risks associated with manned research aircraft acquiring that data. These datasets will allow us to better characterize supercooled liquid water in the Arctic for climate modeling and icing research."

For climate models, there's not much data in the Arctic regarding how much liquid and ice are in the clouds, when and where clouds form, the altitude at which they hover, or how long they last. Clouds containing a lot of liquid in the Arctic are important to understand, as they can act as blankets to warm the surface. Data about the vertical location and concentration of supercooled liquid water in clouds will help atmospheric scientists better understand how these clouds persist for days even though they contain all three phases of water — liquid, ice, and supercooled.

Where bear? There bear!

There are a few dangers presented by wildlife on the North Slope of Alaska but security in this respect is good, says Al Bendure (4132), the range safety officer for the balloon flights. A large klaxon horn, similar to those used to warn town residents of tornadoes, has been installed to warn researchers of upcoming threats. Al stays in communication with oilfield security people who monitor animal movements through the oil fields that cover the isthmus for which Oliktok Point is the last stop before the Beaufort Sea. There is always a person "qualified to carry a 12-gauge shotgun who provides a 'bear watch' during the balloon operations," he says. "It shoots big enough rounds to kill a bear if it attacks a person." But, he says, that last-ditch option has never been used — in previous visits, researchers have retreated to the safety of the arctic shelters on site when a bear was spotted and remained inside until the bear left.

But the balloon itself is a challenge. "These 13-foot-tall balloons can easily lift a person, so we need to stay focused," says Darielle. Ice is expected to form on the balloon and its tether; up to 50 pounds of ice has accumulated on the balloon after flying in clouds. The balloon also can be difficult to control in high winds, and is not launched or retrieved in wind speeds above 25 mph.

Near-continuous temperature profile

Still, "with data from our instrument-laden balloons and its tether, we can sample in situ for long periods of time — maybe the entire life cycle of a cloud layer, and hopefully use that data to parameterize climate models," Dari says. "The models currently represent the arctic surface as colder and more stable than it should be in the winter, which results in fewer and shorter duration low clouds than are really happening. Because our sensor data resolution takes place every meter along the tether and we take temperature readings every 30 seconds, we can measure an almost continuous temperature profile along the entire length of the tether during flight. We'll have a large dataset that isn't being collected elsewhere that will improve our understanding of cloud processes and hopefully improve the accuracy of climate model output."

The ARM Climate Research Facility is a national scientific user facility funded through DOE's Office of Science. The ARM Facility is operated by nine DOE national laboratories, including Sandia. Sandia manages the ARM North Slope of Alaska megasite, which includes Oliktok Point.

COOL SCIENCE — Darielle Dexheimer, right, and colleagues Erika Roesler and Joe Hardesty are using balloon-borne instruments to learn more about supercooled liquid water in the Arctic atmosphere. The data has implications for climate models, aviation, and planetary science.

A large winch allows spooling at a steady pace, letting the helium-filled balloon rise slowly through the bottom, middle, and top of the cloud, before slowly taking it back down.

Informing climate models

Says climate modeler Erika Roesler (6913), who supports the effort, "High enough concentrations of liquid water in clouds can warm the surface of the Arctic through emission of thermal radiation. As the Arctic continues to warm, models will most likely predict that 30 years from now there will be less ice and more liquid in clouds when compared to today's Arctic atmosphere. Data that Darielle is taking will give us a reference point of today for the future and help inform regional climate model predictions."

Says Joe Hardesty (6913), science liaison, "One of the biggest gaps in understanding cloud formation and stability is how the various processes result in persistent seasonal clouds in the Arctic. Supercooled liquid water that switches state to ice, ice nucleation, temperature inversions where clouds become warmer at the top and colder at bottom, and turbulent air flow are all important drivers of cloud formation and behavior. That's why models need to be based on sound science, and why we work with DOE's ARM [Atmospheric Radiation Measurement] program and our partners at NOAA, the University of Alaska, and NASA to generate useful data to improve models for the Arctic."

The work is sponsored through the ARM program of the Biological and Environmental Research Division of DOE's Office of Science.

Mileposts

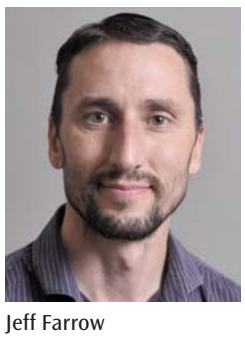
New Mexico photos by Michelle Fleming
California photos by Randy Wong

Ken Reil
40 1384

David Fordham
35 153

John Matthews
25 2245

Christine Barela
15 6511



Jeff Farrow
15 8113

Andrew Lopez
15 2624

Kelly Neely
15 2999

Nathan Roberts
15 5753

Cheryl Stephens
15 2916

Recent Retirees

New Mexico photos by Michelle Fleming

Charles Fuller
47 1729

Dave Morrison
35 256

Amy Levan
15 1446

SANDIA CLASSIFIED ADS

MISCELLANEOUS

WALL BED, Bergman, full size, birch, almost new, you haul, $990. Murphy, 892-0288.

AUDIO VIDEO 5.1 RECEIVER, 100-W/channel, 5 speakers, $100; laptop, HP Pavilion, Win8, 4 GB RAM, 120 GB HD, $75. Pelletier, 884-3726.

BIKE RACK, internal or external, nearly new, for station wagon or SUV, $50 OBO; Delonghi air conditioner, 13,000-BTU, 500-sq. ft., w/dehumidifier, like new, $125 OBO. Summerlin, 275-3703.

EXERCISE EQUIPMENT, Octane Q45e, intelligent elliptical, reg. $3,600, asking $850 OBO; Soloflex, complete w/butterfly & leg attachments, $750; $1,000/both. Hagerman, 505-401-1402.

PORTABLE BASKETBALL HOOP, Lifetime Slamdunk, adjustable height, good condition, $100; 52-in. Samsung LCD TV, needs repair, free. Fernandez, 506-0007.

GUINEA PIGS, 2, females, 4 mos. old, w/cage, bedding, grandchild is allergic, $40. Convissor, 505-828-2137.

CHINA CABINET, antique finish, 3 panels of glass, made by Stanley, $500. Schwartz, 220-6301, call or text.

THREE-HORSE TRAILER, Exiss, stored under cover since purchased, new tires, water tank, excellent condition, $14,000. Kirschner, 505-866-0232.

ARBOR BENCH SAW, tilting, Craftsman Contractor, 10-in., w/bench & w/2 table extensions, $300. Trujillo, 505-344-1259.

BOXES & PACKING PAPER, free. Mabray, 933-2858.

BEDROOM SET, antique, 4-pcs., w/round mirror, beautiful burled maple wood, art deco, have photos, $800. MacCormic, 505-967-7891.

SLEIGH BED, queen, 2 night stands, 5-drawer chest-of-drawers, like new. Anderson, 505-621-6413.

LAMINATED WOOD HEADER, 2"T x 12'W x 20'L, $75; ¾" x 4' x 8' plywood sheets, 3, $12 ea; aluminum ladder, $65; exercise bike, $30; RV chairs, other camping equipment. Garcia, 554-2690.

NIGHT VISION BINOCULARS, 2x, 24 mm, never used, $450. Stubblefield, 263-3468.

COUCH, LOVESEAT, CHAIR, La-Z-Boy, all recline, excellent, bargain, $250; vintage stereo/TV console, $50 OBO. Rodriguez, 505-453-3668.

STORM DOOR, Larson Tradewinds, almond, nickel hardware, UV glass, retractable screen, 32" x 78", cost $400 new, asking $150. Roberts, 505-275-2941.

CHEST FREEZER, Frigidaire, heavy-duty commercial, 35"W x 24"D x 35"H, Cedar Crest, you pick up, $100 OBO. Rosul, 281-4114.

ANTIQUE METAL LATHE, circa 1950s, w/accessories, Craftsman, $500. Putnam, 801-808-1747, by appointment, ask for Jill.

TRANSPORTATION

'08 HONDA ACCORD, 6-cyl., loaded, pearlescent gray, 77K miles, book $12,500, asking $11,250. Cox, 440-0643.

'72 VOLKSWAGEN BEETLE, needs some electrical work, $2,200. Townsend, 352-5390.

'10 VW TOUAREG, luxury SUV, 6-cyl., sunroof, eggshell white, tan leather, service records, 61K miles, $19,500. Burns, 512-636-4629, ask for Anna.

'70 VW CONVERTIBLE BUG, semi-auto transmission, new top, great condition, $5,700. Higgins, 620-282-1463.

'12 FIAT POP 500C, 7,795 miles, $9,500 OBO. Pereida, 948-6874.

'04 TOYOTA SIENNA XLE, leather interior, great AC, runs like new, great condition, $6,000. Torres, 505-401-6900.

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 1468 (Dept. 3651)**
- **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.

'13 VOLKSWAGEN PASSAT SEL, premium, 10.5K miles, like new, http://albuquerque.craigslist.org/cto/5647422227.html, $18,500. Gorenz, 505-401-4650.

'14 JEEP GRAND CHEROKEE OVERLAND, 4x4, hemi, red, tan leather, tow/tech-pkg., 36K miles, excellent condition, $35,000 OBO. Ruiz y Lavery, 505-470-1473.

'06 HONDA CIVIC COUPE, red, clean car, clear title, up to 40-mpg, $5,500 OBO. Wemple, 505-504-4462.

'14 MAZDA 6, loaded, Sirius, navigation, Bluetooth, 26K miles, $23,500. Petre, 505-670-3859, ask for Nancy.

'04 OLDSMOBILE ALERO COUPE GL, silver, fresh tires, new compressor, 166K miles, good condition, $1,700 OBO. Biedermann, 650-804-6393.

'93 F150, extended cab, motor/drive train very well maintained, great trash hauler/work truck, $1,450. Gruetzner, 237-2966.

'98 NISSAN 200 SX, 2-dr., 5-spd., engine likely shot, not running, new clutch/flywheel, alternator, battery, front brakes/rotors, $500. Cancilla, 228-9640.

'07 TOYOTA PRIUS, silver, leather seats, back-up camera, GPS, clean/nonsmoker, 107K miles, great condition, $6,500. Cardona, 505-240-2569.

'14 SUBARU FORESTER 2.5i, fog lights, premium sound, tow pkg., 32K miles, excellent condition, $17,200 OBO. Martin, 623-687-7673.

RECREATION

'12 V-LITE TRAVEL TRAILER, 29-ft., sleeps 5, minimal use, excellent condition, $22,000. Valerio, 505-692-5456.

'10 COACHMAN CATALINA TRAVEL TRAILER, 26-ft., loaded w/options, just serviced, like new, $10,000 OBO. Williams, 505-903-6397.

'97 SCAMP TRAVEL TRAILER, 16-ft., new refrigerator, water heater, AC furnace, microwave, TV, refinished interior, extras, excellent condition, $11,500. Kercheval, 505-266-5833.

REAL ESTATE

ELEGANT HOME, gated community, beautiful Bosque/Rio Grande neighborhood, walk, bike. Hunt, 505-301-8902, ask for Linda.

4-BDR. HOME, 1-3/4 baths, ¼+-acre, 2-car+ garage, gated community, open space, Los Ranchos, MLS#869511, $295,000. Gillis, 505-710-6432, lkgilli@yahoo.com.

TRIPLEX, 500-sq. ft. units, good rental investment, close to base, VA Hospital, MLS#848840, $108,000. Caruso, 505-459-8286.

3-BDR. HOME, 2-1/2 baths, 2,031-sq. ft., corner lot, move-in ready, La Cueva Oeste, $267,900 OBO. Peters, 505-293-9700.

4-BDR. HOME, 2-3/4 baths, 2,300+-sq. ft., near UNM, base, stainless appliances, granite, 1204 Hermosa SE, MLS#868842, $325,000. Kravitz, 505-250-1945.

4-BDR. HOME, 3-car garage, refrigerated air, granite, stainless steel appliances, Paako subdivision, $395,000. Gallegos, 505-261-3217.

4-BDR. HOME, 4 baths, 3-car garage, 3,300-sq. ft., hardwood throughout, granite, 3 balconies, mountain views, 3 miles from base, Volterra, $399,000. Cooper, 505-322-8700.

WANTED

ROOMMATE, share 3-bdr. home, close to base & bus lines, $400/mo., utilities included. Roche, 505-366-3884.

ROOMMATE, Westside, close to freeway, clean house, no pets, $600/mo., utilities included. Padilla, 505-400-7268.

Sandians celebrate Pride, come together for Orlando

By Lindsey Kibler

An enthusiastic group of some 40 Sandians, accompanied by friends and family, showed their support for the Sandia Pride Alliance Network, or SPAN, by representing the Labs in the 2016 Albuquerque Pride Parade.

This is the second year Sandia, in partnership with the National Museum of Nuclear Science & History, has entered a float in the parade. The Labs' involvement serves as a way to affirm Sandia supports the state's lesbian, gay, bisexual, and transgender (LGBT) community, and as a recruiting tool to inform people that their sexual preference does not prevent them from obtaining a security clearance.

"The parade was great. Our float coordinated perfectly with the parade's theme of 'Bridges'; we constructed three spans of balloon arches over the float. Also our name, SPAN, invokes a bridge, which is part of our organization's objective — to build bridges across diversity challenges," says SPAN chair Chris LaFleur (6231).

The day after the parade, in Orlando, Florida, 49 people were killed at the Pulse nightclub, a gay club. It was the worst mass shooting in US history.

Ten days after the shooting, SPAN hosted the All Hands for Orlando gathering as an opportunity for Sandia to come together to show support and to grieve together.

"We needed to respond to this tragedy by coming together to feel the love and support that will allow us to heal," Chris says. "Suffering the pain and shock of an event like this is made harder by isolation."

Chris says the shootings affected her deeply and made her reflect on the role gay bars have played for the LGBT community.

"Beginning with the Stonewall Inn riots in 1969, when it was illegal to be homosexual in America and the police were the ones attacking the gay citizens," Chris says, "gay bars and nightclubs were our gathering places, where it was safe to be who we are, where we found our security and identity as a community. These were the only places where we could dance, flirt, and even hold hands without worrying about being attacked. That same night [of the Orlando attack] many in Albuquerque had celebrated pride in the gay and gay-friendly bars here. It could have been any of us."

Although it may have been an isolated incident, the Orlando attack reinforces the need for people to understand and respect one another every day, Chris says.

In a message to all members of the workforce, Sandia President & Laboratories Director Jill Hruby wrote, "This is a good time to remind ourselves how important diversity and inclusion are to our success as a laboratory. We rely on people with diverse backgrounds, beliefs, and lifestyles to bring different perspectives to the hardest problems we are asked to solve. As an institution and as individuals, we are united in our commitment to providing the best engineering and science to the nation."

SANDIA PRIDE ALLIANCE NETWORK (SPAN) members and friends mug for the camera before beginning the miles-long march from UNM's Johnson Field to the New Mexico State Fair Grounds for the city's 2016 Pride Parade. This is the second year Sandia, in partnership with the National Museum of Nuclear Science & History, has entered a float in the festivities. (Photo by Christopher Leno)

SANDIA PRIDE ALLIANCE NETWORK

SPAN, most recently known as Sandia's Gay, Lesbian, Bisexual, and Transgendered Networking Group, was founded in the late 1990s and is open to all Sandians. It welcomes new members and allies, a term used to describe people who support the LGBT community. Its goal is to contribute to a safe, hospitable, supportive, and productive workplace for all employees regardless of sexual orientation, gender identity, race, national origin, gender, religion, age, veteran status, physical and mental challenges, and marital status. More information is at http://info.sandia.gov/glbng/.

Join forces

Military students get a taste of national lab research, a win-win for them and Sandia

FUTURE LEADERS — Students from West Point and other US military academies are at Sandia this summer as part of NNSA's Military Academic Collaboration. The program gives the cadets real-world research experience and helps Sandia build relationships. (Photo by Randy Montoya)

By Nancy Salem

Army 2nd Lt. Willahelm Wan, a West Point graduate pursuing a master's degree in electrical and computer engineering at Northeastern University, found a path in an unexpected place. Two years ago, he signed on to spend a few summer weeks at Sandia in a real-world research environment. What he learned changed his career.

"At Sandia, everything is connected," he says. "Projects have multiple components and overlap between departments. I considered myself a mechanical engineer, but saw that computer simulation, software, and programming are critically important to engineering."

Wan began his junior year at West Point after leaving Sandia that summer and added a second major to his engineering curriculum – computer science. And he decided return to Sandia this year, in cybersecurity. "I love working here," he says. "It's great to explore different areas of Sandia. I learn so much."

Wan is one of 45 students participating in this summer's Military Academic Collaboration, or MAC, at the Labs. The seven-year-old program was started by NNSA to engage US military educational institutions and give students at West Point, the Naval Academy, the Air Force Academy, the Coast Guard Academy, and the Merchant Marines a taste of research in the nuclear security enterprise. Sandia, Los Alamos National Laboratory, Lawrence Livermore National Laboratory, Pantex Plant, Kansas City National Security Campus, Y-12 National Security Complex, and the Savannah River Site participate in MAC.

A great work ethic

"The students are here for a condensed time frame, three-and-a-half to six weeks," says Staci Dorsey (215), who coordinates the program at Sandia. "It's geared toward hands-on research. They often say they don't expect to accomplish much, but they actually do. They accomplish a lot."

The students have military training and a great work ethic, Staci says. "They finish a task and ask for more," she says. "These are exceptional young adults who want to serve the country. They know what they want to do with their lives — protect and serve. They are motivated and have a passion for what they are doing. To me, that's outstanding. It's very rewarding to work with them."

Each fall, Staci seeks out project leads willing to host one or more military students. It's not a hard sell. The students come with clearances, and there is no cost to Sandia. The Department of Defense and NNSA pick up the tab.

A portfolio of jobs for the cadets

Staci builds a jobs portfolio and joins coordinators from other labs on visits to the campuses of the major military institutions. Most of the jobs are in technical areas such as physics, cybersecurity, biotechnology, materials science, and mechanical engineering. But Staci says there have been positions in economics, psychology, and other areas. "Our pitch is to come to Sandia and do something completely different for a short period of time," she says.

Interested students are matched with jobs and offers are made, but not all are approved by the schools, which have the final say on who will go, taking into account such factors academic standing and training schedules. "This year we made 70 offers and 45 were approved," Staci says.

MAC host Bruce Kelley (6600) says the program lets cadets see the breadth and depth of Sandia, and gives the Labs bright, hard-working people. "The students work to come up to speed quickly on projects for which they often have limited familiarity," he says. "We had one student who designed his own research project when he got here and continued to work on it when he went back to West Point. He then published an article on his work."

Noel Nachtigal (8966), who has hosted MAC students at Sandia/California, says the cadets are curious self-starters. "This gives them a view into the kinds of things a national security lab does and an opportunity to contribute in a meaningful way to an ongoing, operational program," he says. "It's an awesome opportunity, for them and for us."

Building relationships with future leaders

The program has grown every year, from six in fiscal year 2011 to the current number. Last year there were 29. MAC is not considered a talent pipeline for Sandia because the students commit to military service or more education after they graduate. "Some students go into the military as officers and others go to grad school," Staci says.

But the Labs builds relationships through the program. Staci says the students could become military leaders and remember their time at Sandia. "We want them to consider the Labs as a resource if they need help with a problem," she says. "We want to partner with these future military leaders."

Bruce says the students see the range of Sandia's work, "and hopefully they carry a positive impression of the Labs and its capabilities through their careers."

Michaela McKeown, an incoming senior at the Coast Guard Academy, says her work at Sandia developing bioimaging agents at the Advanced Materials Laboratory has been beyond memorable. "I'm a mechanical engineer working on a chemistry-based project, and I've learned more than I ever dreamed possible," she says. "I'm excited to tell my instructors and fellow students what I've been doing this summer. It far exceeded my expectations."

Wan says the program inspired him to reach farther. "This was different from school. This was real," he says. "I was able to absorb new knowledge. I won't forget."

US Merchant Marine Academy | US Air Force Academy | US Military Academy | US Naval Academy | US Coast Guard Academy