



SOLAR INDUSTRY PARTNER — Joshua Stein (6112) leads the US Regional Test Centers (RTCs), a network of five sites across the country where industry can assess the performance, reliability, and bankability of solar photovoltaic technologies. Sandia and centers in Colorado, Nevada, Florida, and Vermont offer testing and evaluation at the system level in a range of climates.

Joshua, above, checks one of several systems being evaluated for industry partners at Sandia. The program funded by the DOE SunShot Initiative will “drive the market penetration of smarter, more efficient solar systems,” Joshua says. See story on page 8.

(Photo by Randy Montoya)

COLD WAR WARRIORS
A new documentary. Page 12

Exceptional service in the national interest

Sandia LabNews

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ZERO WASTE → 2025

REDUCE • REUSE • RECYCLE • BUY GREEN

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Lessons from cow eyes

By Mollie Rappe

Nature has had millennia to optimize biomaterials for useful properties, from lightweight strength to walking on smooth, vertical surfaces. Mother-of-pearl, spider silk, cholla wood “skeletons,” and gecko feet are all good examples of nature’s brilliant materials engineering. The study of gecko feet spurred research into dry nano-adhesives, and research into lightweight yet twist-resistant tubes re-discovered the structure of cholla wood.

Cornea tissue is a promising biomaterial for Sandia materials scientist Brad Boyce (1851). More than a decade after Brad and his co-workers investigated the biomechanics of dissected cow corneas, their findings have been confirmed in healthy human eyes.

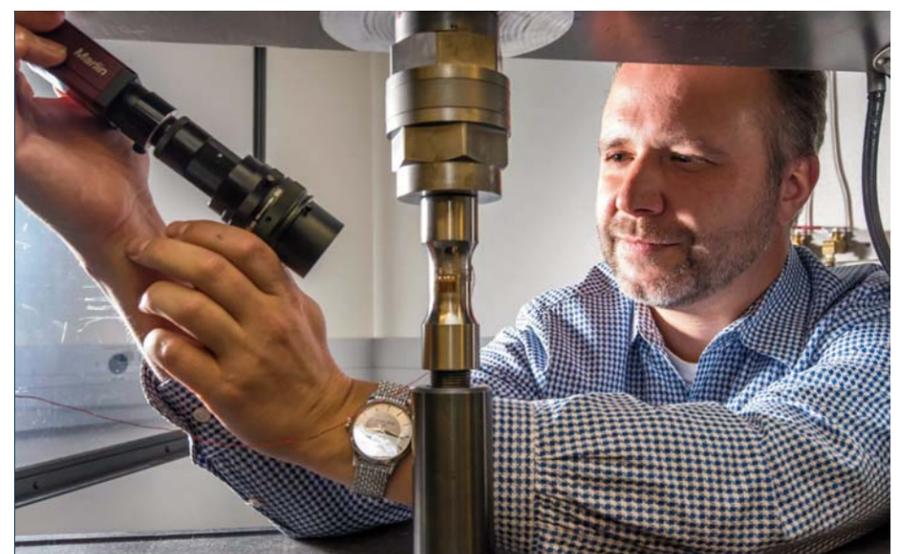
In 2003, after attending a seminar on the mechanical properties of red blood cells, Brad was inspired to write an unconventional Laboratory Directed Research and Development (LDRD) proposal. “Let’s do the mechanics of the eye, I think that’s easier than a red blood cell. I think we can handle that,” Brad remembers suggesting to a co-worker. To their surprise, the proposal was funded.

Brad, Mark Grazier (1831), Reese Jones (8343), and Vicky Nguyen, now an engineering professor at Johns Hopkins University, brought new skills to the study of the cornea. Brad and Mark came from a materials science perspective while Reese and Nguyen offered powerful computational mechanics modeling skills.

Why the eye?

The cornea helps focus light before it hits the lens and serves as the transparent cover over the iris and pupil, protecting the eye from scratches and other injuries. The cornea also has to deal with the challenge of pressure changes within the eye. In an average human eye, pressure decreases about 25 percent from morning to evening.

The cornea is made up primarily of layers of collagen fibrils arranged in a peculiar manner.



SANDIA MATERIALS SCIENTIST Brad Boyce tests the mechanical properties of materials. Brad typically studies metallic materials, but an unconventional foray into the biomechanics of slaughterhouse cow eyes has paid dividends. (Photo by Randy Montoya)

In the center of the cornea, over the pupil, sheets of fibrils are interleaved alternating between vertical layers and horizontal layers. On the outside of the cornea, near the sclera, or white of the eye, the fibrils curl parallel to the cornea edge, like ribbons around the brim of a hat.

“It still amazes me that the spacing of the fibrils is so well tuned for stability and transparency that the modest swelling accompanying death leads to cloudy corneas,” Reese says.

Brad and his co-workers sought to understand how the cornea adjusts for those daily pressure changes and how the physical structure dictates its mechanical properties. It turns out this fundamental understanding has direct implications for glaucoma detection and Lasik, a popular vision correction process in which a laser reshapes the cornea. However, the broader aim of Sandia’s LDRD project was insight into soft tissues, in general, with the moonshot goal of aiding in the design of next-generation body armor.

Pressurizing cow eyes to fight glaucoma

“You open up this insulated cooler and there’s a bunch of cow eyes looking back at you, not the best way to start a Monday morning. I’m not a biologist and I didn’t go into medicine

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That's that

If you google the question "Who's the smartest person in the world?" the first hit you get is Stephen Hawking, the legendary English theoretical physicist, cosmologist, and visionary. He is one of the world's most recognizable personalities and when he expounds on subjects that interest him, people listen.

That's why ears pricked up when Hawking started warning that the development of advanced artificial intelligence – self-aware, self-motivating, superintelligence – is not necessarily an unqualified boon for humankind. As he wrote in an essay a couple of years ago, "Success in creating AI would be the biggest event in human history. Unfortunately, it might also be the last, unless we learn how to avoid the risks."

The potential benefits are huge: Machines that are smarter than we are could help us solve and put to rest some of our most intractable problems: war, disease, poverty – those seeming incurable plagues of mankind might become things of the past, anthropological relics of our collective childhood. But with superintelligent AI in the driver's seat, what would our childhood's end really look like? Hawking cautions that it might not be so pretty:

"One can imagine such technology outsmarting financial markets, out-inventing human researchers, out-manipulating human leaders, and developing weapons we cannot even understand. Whereas the short-term impact of AI depends on who controls it, the long-term impact depends on whether it can be controlled at all."

Hawking says we need to start figuring out right now how we are going to control what would essentially become a competing intelligent species of our own creation. Will we be its masters, or its servants?

Hawking's not alone in his concerns. After reading the book *Superintelligence* by Nick Bostrom, no less a figure than Elon Musk, father of Tesla Motors, SpaceX, and PayPal, tweeted: "We need to be super careful with AI. Potentially more dangerous than nukes."

Of course, not everyone is quite so nervous about AI, or at least don't consider it an urgent now-or-never issue. Michio Kaku, a theoretical physicist and well-regarded science popularizer, said just this month that he thinks the ascendancy of AI is still decades away.

"By the end of the century this becomes a serious question, but I think it's way too early to run for the hills. I think the *Terminator* idea is a reasonable one – that is, that one day the internet becomes self-aware and simply says that humans are in the way. After all, if you meet an ant hill and you're making a 10-lane super highway, you just pave over the ants. It's not that you don't like the ants, it's not that you hate ants, they are just in the way."

In other words, we don't need to run to the hills, but our grandkids do. Cold comfort, that.

* * *

I'm with the John Lithgow character in the movie *2010- The Year We Make Contact*. When it appears that the survival of the human crew of the *Discovery* spacecraft may come down to sacrificing HAL by lying to him about a change in mission plans, there is much agonizing over the issue. HAL's "father," Dr. Chandra, says, "Whether we are based on carbon or silicon makes no fundamental difference. We should each be treated with respect." Walter Curnow (the Lithgow character) can't believe what he's hearing: "So our choice is him or us? Well, I vote us. All opposed? The ayes have it." (By the way – SPOILER ALERT – the crew ultimately tells HAL the truth, that for them to survive, he must "die." HAL, fully informed, makes the decision to sacrifice himself for his crewmates.)

* * *

Pondering Stephen Hawking's concerns about AI, my thoughts turned to former New Mexico Gov. Bruce King, who served as the state's governor for three terms. King was a perennial favorite, a skilled politician who also was well-liked – beloved may not be too strong a word – by a large cross-section of New Mexico voters. He was also known to occasionally mangle the English language in ways that would make Yogi Berra blush. But like Yogi, King had a way of saying things that, though funny on their face, actually made sense. My favorite King-ism was the time he warned state legislators that if they passed a particular bill he opposed, they would "open up a whole box of Pandoras." Following King's lead, I ask: How many Pandoras are gonna fly out of that AI box.

In this political season, let me offer up a little more King. At the opening session of the state Legislature during his first year as governor, King, who called his autobiography *Cowboy in the Roundhouse*, said, "Let's saddle up and ride out, answerin' wrongs where we can, settin' things right where we can." I like that "where we can." Because there is always only so much you can do. Trying to do more often results, as a wise man once said, in opening up whole boxes of Pandoras.

See you next time.

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

Sandia named a top employer for Native STEM professionals

By Valerie Larkin



AMERICAN INDIAN SCIENCE AND ENGINEERING SOCIETY
A Universe of Opportunities

Sandia has been named one of the Top 50 Workplaces for Native STEM Professionals by the American Indian Science and Engineering Society (AISES).

Employers who made the list have demonstrated they foster an inclusive work environment, have programs that support individual staff

members, and have recruited STEM professionals from Native American and Alaska Native populations within the last two years. This is the first time Sandia has received this recognition.

Esther Hernandez (3010), Sandia's chief diversity officer, says, "This recognition helps brand not only Sandia but also the national labs as a good place to work. This has been an area of focus for us, so it's an honor to be on this list."

AISES is a national nonprofit organization focused on increasing the representation of American Indians, Alaska Natives, Native Hawaiians, Pacific Islanders, First Nations, and other indigenous peoples of North America in STEM studies and careers.

Sandia's American Indian Outreach Committee (AIOC) supports AISES through various volunteer activities, actively recruits the organization's students, and annually nominates Sandians for AISES professional awards. Aaron Niese, AIOC chair and manager of Software Simulation and Data Processing (5567), says, "AISES is nationally known in Native STEM advancement. Receiving this visibility is great for Sandia."

New pension video answers frequently asked questions

By Amy Treece

If you are a participant in Sandia's pension plan, a new video featuring Evan Ashcraft (10520), one of Sandia's investment managers for Pension and Savings Plans, may be a good resource for you. It answers frequently asked questions such as:

- What is the Annual Funding Notice and what does it mean?
- Is our pension adequately funded?
- Can plan assets be used for any other purpose?
- If there is a change in the management contract for Sandia, will my pension be bought out or lost?
- Are there other ways the plan can be discontinued?
- When I retire, does Sandia buy me an insurance annuity?
- Can my monthly pension amount be changed after I retire?

To view the video, go to <https://hbeupdate.custhelp.com/app/video/>.

If you have questions that aren't answered in the video, you have options. As a current employee, you can use the pension estimating tool to run scenarios to estimate your pension benefit. Go to HR Self Service on the Techweb home page, then to Benefits & Retirement, and click on Pension Estimates. As a retiree with questions about your monthly payment, contact Prudential Retirement Services at 1-800-621-1089

If you have general questions about plan benefits or retirement eligibility, contact the HBE Help Desk at 505-844-HBES (4237). For questions about the Annual Funding Notice, call the team in Retirement Investment Management at 505-845-0303.



LAURENCE BROWN (163), Tribal Government Relations manager and co-chair of the AISES Corporate Advisory Council, says, "This is a great recognition of the tremendous talent pool of American Indian professionals at the Laboratories."



Sandia National Laboratories

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Good neighbors

Sandia/California brings 60th anniversary into the community May 21



By Patti Koning

Sandia/California will commemorate its 60th anniversary at a community event in downtown Livermore on Saturday, May 21, from 10 a.m. to 2 p.m. Held at the Bankhead Theater at 2400 First Street, the event will feature technology displays and demonstrations, national security speakers, hands-on science activities, and recruiting.



The Perfect Heist

“We take great pride in all that has been accomplished at this site over the past 60 years and want to share this with the community,” says Marianne Walck, vice president of Sandia’s California site and the Energy and Climate program. “This event is a chance to showcase some of the important work that happens here.”

Inside the Bankhead’s 500-seat theater, Labs Director Jill Hruby and Marianne will speak about the history and continued impact of Sandia and the California site. The theater program will also feature remarks by Congressman Eric Swalwell, State Senator Steve Glazer, Assemblymember Catharine Baker, Alameda County Supervisor Scott Haggerty, Livermore Mayor John Marchand, and LLNL Deputy Director Thomas Gioconda. The program will conclude with two national security speeches: Jarret LaFleur (8118), “The Perfect Heist,” and Levi Lloyd (8965), “Cybersecurity: Challenges and opportunities in the digital age.”

The breadth of Sandia/California’s work will be on display in the theater lobby. Highlights include:

- An additive manufacturing display with 3-D printed memorabilia giveaways
- Visualizations of the Combustion Research Facility (CRF)’s

Sandia’s mobile imager of neutrons for emergency responders (MINER)



Lizzie Fountain Park, Livermore, California
Image source: Google StreetView



SpinDX

high performance computing-enabled flame modeling and measurements

- An optical engine used in the CRF’s engine optimization research
- A photobioreactor filled with growing algae destined for bio-fuel and a microscope stage to show algae predators at work

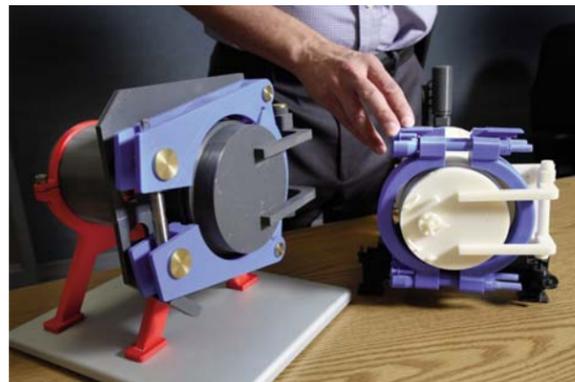
- The SpinDX portable bio-detection unit that runs an array of medical tests from a single drop of

blood in about 15 minutes

- A cybersecurity booth featuring demonstrations of password cracking, computer forensics, and encryption method comparisons
- Samples of hydrogen-embrittled metals from Sandia’s research to understand and mitigate the effects of hydrogen on different materials

- An overview of the Explosive Destruction System (EDS) including a small-scale model, examples of post-processed hardware, and videos of past EDS missions
- Sandia-developed radiation detection capabilities including the R&D 100 award-winning triplet harvesting plastic scintillators and anti-neutrino reactor monitoring

- A historical overview of Sandia/California and its national security work



A model of Sandia’s Explosive Destruction System

- A fuel-cell electric vehicle, courtesy of the California Fuel Cell Partnership (outside in front of the Bankhead Theater)

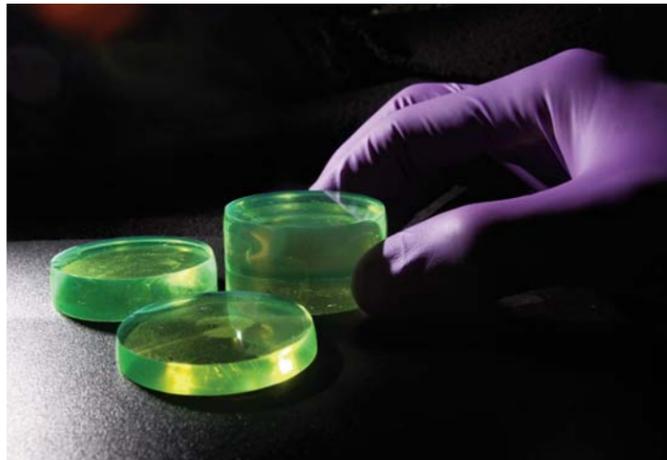
The event also will showcase the site’s education outreach programs with hands-on scientific activities from Family Science Night and Expanding Your Horizons volunteers. Students from two Livermore schools — Livermore High School and Mendenhall Middle School — will display their engineering projects.

The human resources department will present another aspect of Sandia/California — as a workplace. Recruiters will

be on hand to share information about Sandia careers and job opportunities.

“We are fortunate to work in such an incredible place full of natural beauty, wonderful people, history, and a vibrant economy,” says Marianne. “We invite the community to share in the celebration of Sandia/California’s first 60 years and what we hope to achieve in the next 60 years and beyond.”

For more info, see CA60.sandia.gov.



Triplet-Harvesting Plastic Scintillators

Getting better all the time

Payroll Services and Accounting Services win Quality New Mexico Performance Excellence Awards

By Amy Treece

For the two Sandia teams honored during this year's Quality New Mexico awards event, it's all about improvement — tangible, sustainable, and continuous improvement. The self-assessment process is rigorous, they say, and demands working beyond conventional comfort zones, but the payoff is worth the effort for themselves and, more importantly, their customers.

The teams, Accounting Services and Payroll Services, each received the Quality New Mexico 2015 Performance Excellence Award at the annual Quality New Mexico Learning Summit and Performance Excellence Awards ceremony. Both groups received Piñon-level recognition based on the Malcolm Baldrige framework for performance excellence. This recognition level indicates that these organizations use systemic processes, emphasize coordination, and focus on long-term benefits.

Easy to become complacent

Payroll Services team members say it is easy to become complacent when performance is "good." But they wanted to be more than "good." And Bill Worden (10511), manager of Accounting Services, says the competition allowed his organization to reflect on how it manages its operations and focus on its objective of providing accurate and timely financial and tax information at the federal, state, and local level. Both groups agree they wanted that external feedback to provide a fresh perspective on how they could move the excellence needle even further.

To receive a Baldrige Award, organizations must excel as role models in operational management, ensure continuous improvement in delivering products and/or services, provide efficient and effective operations, and show responsiveness to customers.

That responsiveness has given Payroll Services higher marks in customer satisfaction. Dan Berry (10615), the Payroll Services manager during 2015 says that last year, the organization adjusted the way the helpline worked.

"We extended our helpline hours and implemented a new phone system. Before, only one person could be on the helpline, so if you called and someone was on the phone, it would go to voicemail. This new system allows three people to be on the helpline simultaneously."

In Accounting Services, team members began documenting processes to ensure that all sources are connected and can be updated together when new guidance is received from oversight groups.

"We are responsible for financial and tax reporting so it is crucial to be adaptable and meet the needs of DOE/NNSA," says Bill. Their robust system has been implemented in key operational areas and shared with other labs. This first win for Accounting Services takes the group one step closer to its goal of leading the DOE Complex as the model Accounting Services organization.

Second time honored

This year's award marks the second time Payroll Services has been recognized by Quality New Mexico. It also received an award in 2013, and in both award-winning years, accuracy got the team noticed — accuracy in processing a large volume of paychecks each bi-weekly payroll period (11,646 paychecks at the end of March) and accuracy in employee W-2 forms.



MEMBERS OF THE ACCOUNTING SERVICES AND PAYROLL SERVICES teams gather in the lobby of the IPOC building for a family portrait. The two teams were recognized at the annual Quality New Mexico Learning Summit and Performance Excellence Awards ceremony with Piñon-level awards for strides they have made on their quality journeys. (Photo by Randy Montoya)

This past year, the accuracy rate in employee W-2 forms was well above best practices, at 99.95 percent.

"We have to have strong relationships with all of our business partners to ensure we're delivering accurate paychecks," says Tristan Walters (10512), Payroll Services manager. "The paycheck is only the final output of an integrated process that can require inputs from Staffing, Benefits, Compensation, and our HR Business Partners. We also must confirm our system can accurately track all the different leave plans and other benefits offered by the Labs. To ensure all this is running smoothly, we team on a constant basis."

Quality New Mexico mentioned in its formal remarks that Sandia's Accounting Services group understood workforce management and performance processes. Sandia's Payroll Services group was lauded for understanding the value of people and realizing that its success depends on an engaged workforce that benefits from meaningful work and clear organizational direction.

These Sandia teams aren't resting now that they have the wins under their belts. Payroll Services, says Tristan, is trying to better understand customer segments so it can develop targeted solutions, and Accounting Services, says Bill, is documenting policies and procedures for audit purposes and for guiding other Sandia entities.

Cow eyes

(Continued from page 1)



for a reason. I get queasy if I see blood," says Brad.

Brad and Mark overcame their squeamishness to cut the cornea from slaughterhouse cow eyes and Super Glue them to a specially designed pressurization chamber. Using a computational image triangulation technique known as Digital Image Correlation they discovered the reason behind the peculiar collagen fibril arrangement.

Under near-normal pressures, the perpendicular arrangement of collagen keeps the center of the cornea stiff. On the other hand, the parallel fibrils give the rim enough flexibility to bulge or deflate to adjust to the eye pressure. The researchers speculated that this allows the central field of vision to remain more or less constant.

In December 2015, these results were confirmed in

healthy human eyes by Ahmed Elsheikh and colleagues at the University of Liverpool. Now, the initial discovery by Brad's team can be unambiguously applied to Lasik technique development and other ophthalmological uses.

"We had hoped that this would translate to humans, and now that it's been proven to translate to humans, it feels like it's come full circle. Beyond that, it's just reassuring that you're doing all right in the lab, when somebody else gets the same result after a few years," says Brad. The LDRD project directly led to four biomechanics publications in addition to dozens of publications from Nguyen's lab.

Continuing biomechanics research at Johns Hopkins University

In addition to providing the foundation for Elsheikh's work, the LDRD project had another direct, practical impact that helps those suffering with glaucoma. Soon after the three-year project wrapped up, Nguyen left Sandia for a professorship at Johns Hopkins University.

Since Sandia wasn't going to continue the work, Brad and the team helped Nguyen pick up where it left off. Biomechanics of soft, flexible tissues, such as cornea and skin, is the cornerstone of her lab's research.

"We modified the inflation method originally developed at Sandia to measure strains in the sclera, the white part of the eye. This region of the tissue is interesting because it influences the deformation and stresses experienced by the optic nerve. Excessive stress can cause progressive dysfunction and death of the optic nerve axons in patients with glaucoma, leading to blindness," Nguyen says. "These results have motivated the development of glaucoma therapies that modify the connective tissues of the sclera — either by stiffening or softening — to arrest the progression of the disease."

In addition, Nguyen has expanded her research to investigating the biomechanics of the whole eye. She has studied the effect of glaucoma and explosions on the biomechanics of the eye. She has used mice models of glaucoma to test pharmaceutical agents for the prevention of glaucoma. In yet another benefit from the work, some of the researchers she has taught have come to work at Sandia, forming a sort

of symbiotic pipeline.

"I'm glad because I don't have to look at cow eyes anymore and I have other projects to worry about, but I'm also glad that somebody else has picked up that baton and run with it," says Brad.

Far-flung long-term impacts

Less directly, the project helped build expertise at Sandia in Digital Image Correlation (DIC), the computational triangulation technique they used. DIC closely monitors deformation of an object. Using many high-contrast speckles, two cameras and triangulation results in sub-pixel resolution. DIC was an up-and-coming technique when the team first used it; by studying cornea deformation the researchers gained a thorough understanding of it. Today DIC is a powerhouse technique that Brad uses daily.

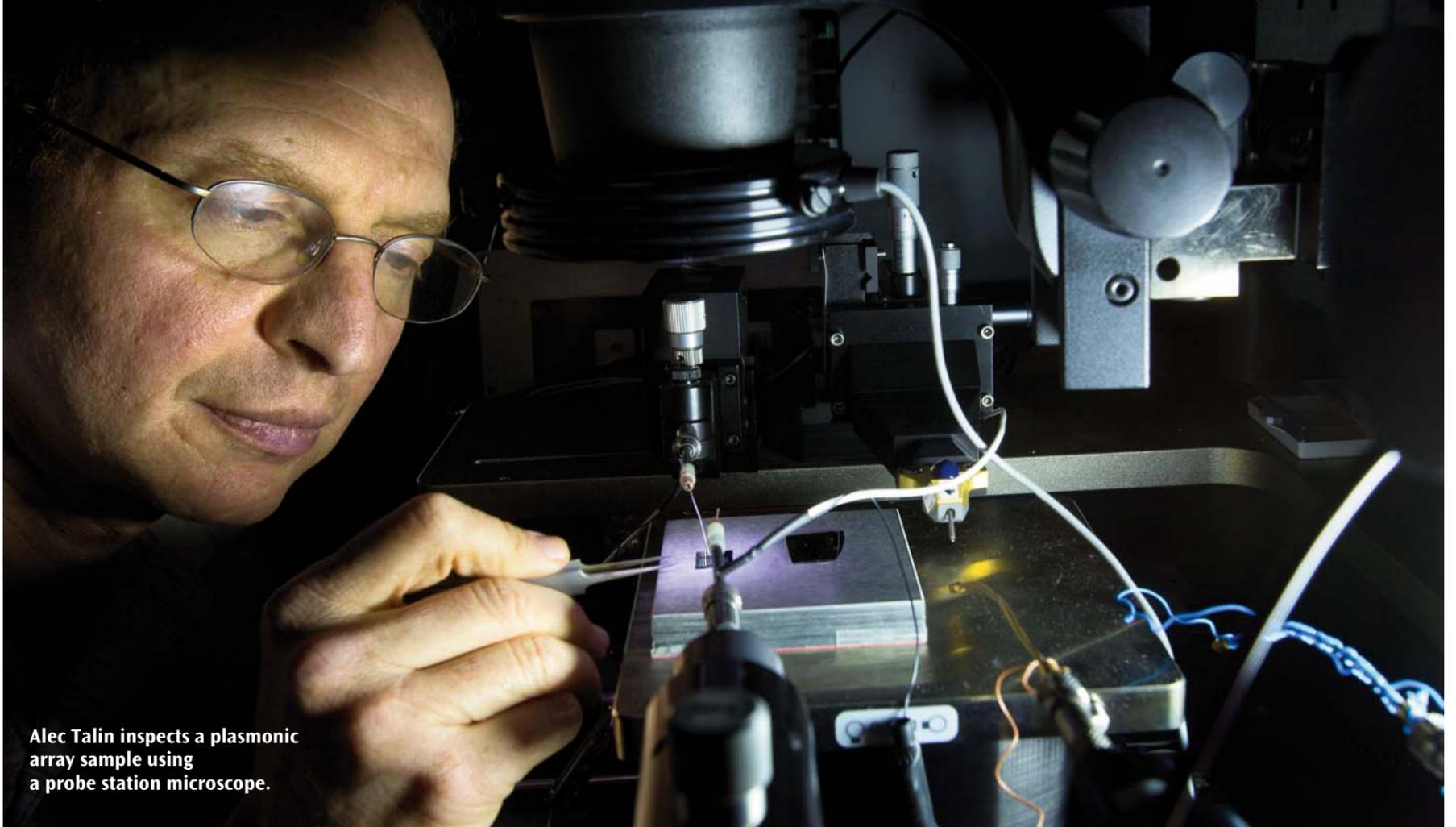
In addition to gaining technical expertise, the heterogeneity of the cow corneas made an impression on Brad's overall approach to research.

"The cornea is probably the first project that really hit me over the head to say 'You have to get your arms around materials variability, you can't do business as usual for metallurgy,'" says Brad.

This materials variability thread has run through many of his other major projects such as the Engineering of Materials' Reliability Research Challenge and the Predicting Performance Margins projects. Engineering of Materials' Reliability is a decade-long, interdisciplinary effort to develop a framework for predicting material variability with the goal of designing products that meet all requirements on the first try. Predicting Performance Margins uses the science of microscale structural differences to predict the variability large-scale object properties.

"LDRDs are supposed to be these far-reaching, long-distance projects that aren't going to necessarily have a payoff three or five years down the road. So many times people are off doing something different by that time that nobody even notices the long-term impact. I just happen to have sat at this desk for 15 years so I could see that long-term impact," says Brad.

Ingenious method enables sharper flat-panel displays at lower energy costs



Alec Talin inspects a plasmonic array sample using a probe station microscope.

By Neal Singer • Photo by Dino Vournas

A perpetual quest of manufacturers and viewers is for ever-brighter colors and better images for flat-panel displays built from less expensive materials that also use less electricity.

An intriguing method discovered by Sandia researcher Alec Talin (8342) and collaborators at the Center for Nanoscale Science and Technology at the National Institute of Standards and Technology may be that next step. It uses super-thin layers of inexpensive electrochromic polymers to generate bright colors that, for the first time, can be altered rapidly. The work was reported in the Jan. 27 *Nature Communications*.

Electrochromic polymers by themselves are not a new invention. They change color in response to an applied voltage and only require energy when switched between colored and transparent states. But until Alec and his collaborators, no one had figured out how to switch electrochromics on and off in the milliseconds required to create moving images.

The problem lay in the thickness of the polymer. Conventional electrochromic displays require thick polymer layers in order to obtain good contrast between bright and dark pixels. But thick layers also require long diffusion times for ions and electrons to change the polymer's charge state, making them only useful for static information displays or darkening windows of a Boeing Dreamliner, but not in the milliseconds needed for an action flick or even a roundtable discussion. On top of that, a full color display requires three different polymers.

The researchers got around the rapidity problem with a tiny but spectacular innovation: They created arrays of vertical nanoscale slits perpendicular to the direction of the incoming light. The slits were cut into a very thin aluminum track coated with an electrochromic polymer. When light hit the aluminum nanoslits, it was converted into surface plasmon polaritons (SPPs), which are electromagnetic waves containing frequencies ranging from ultraviolet to infrared that travel along the dielectric interfaces — here, of aluminum and electrochromic polymer.

The distance between the slits in each array (pitch) corre-

sponded exactly to the wavelengths of red, green, and blue light. The pitch determined which wavelength — red, blue, or green — was transmitted down through the array, traveling along the interface between the thin polymer layer and the aluminum substrate.

Because the polymer was just nanometers thick it required very little time to change its state of charge and, therefore, its optical absorption of colored light.

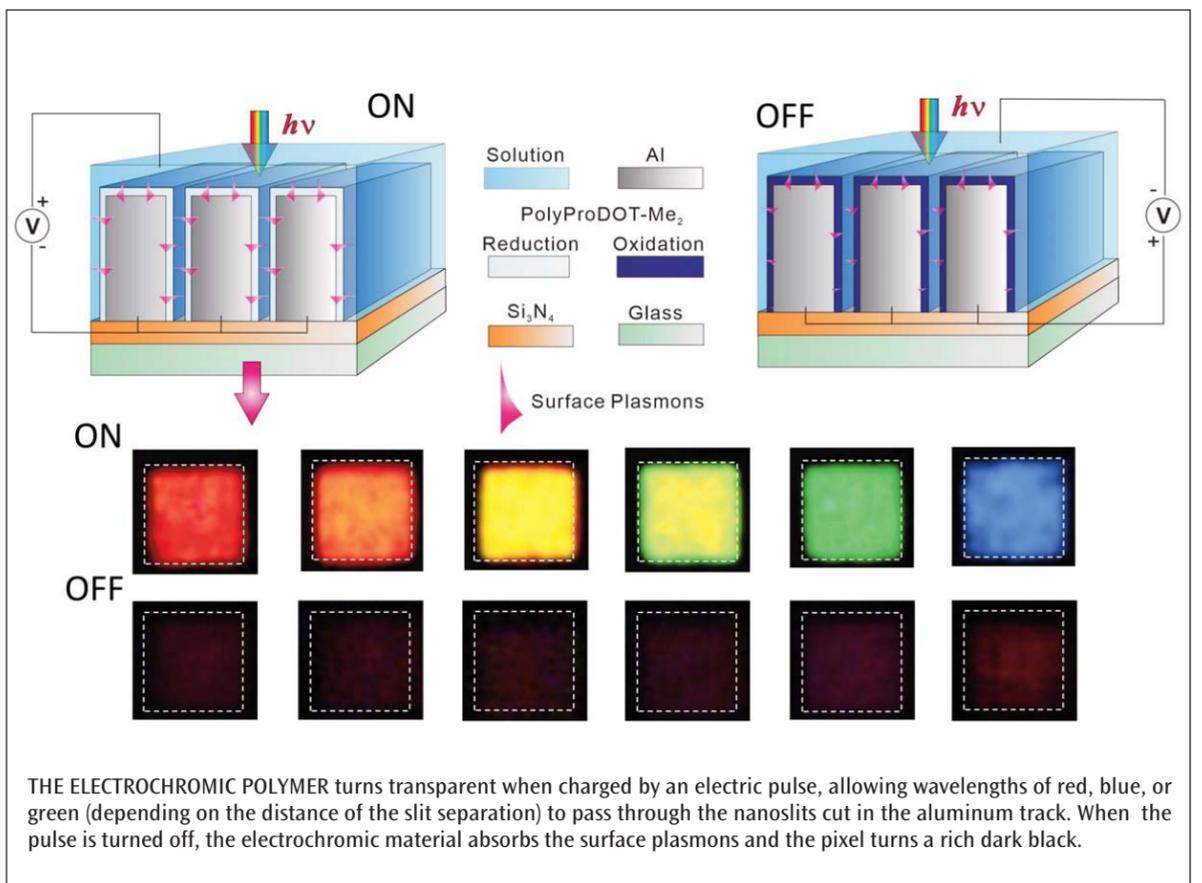
However, because the light traveled a relatively long distance down the surface of the aluminum slits coated with the thin polymer, it saw a much thicker polymer layer.

The material turned a desirable deep black when a tiny electric current sent across the top of the slit cut off the entering light, and did so in milliseconds. When the cur-

rent was flicked off, light frequencies passed through the slits and instantly turned on the pixel. As an additional bonus, because the carefully spaced slits let in light only at a particular frequency, a single kind of polymer coating could serve as a neutral party and delivered all three emanated colors.

“These very inexpensive, bright, low-energy pixels can be turned on and off in milliseconds, making them fit candidates to provide improved viewing on future generations of screens and displays,” says Alec. “The nanoslits improve the optical contrast in a thin electrochromic layer from approximately 10 percent to over 80 percent.”

The work was supported at Sandia by Nanostructures for Electrical Energy Storage, a DOE Energy Frontiers Research Center.





ZERO WASTE 2025

REDUCE • REUSE • RECYCLE • BUY GREEN

Sandia needs 'Zero Heroes' to meet 2025 goal

By Lindsey Kibler

It's hard to miss the kiosks prominently displayed at turnstiles and in lobbies around Sandia: a Zero Hero proudly displaying the "Z" emblem through a neatly pressed business shirt and tie. He represents the power each person has to reduce waste at Sandia — thus becoming a Zero Hero — and is part of a newly launched Zero Waste campaign by Sandia's Materials Sustainability and Pollution Prevention (MSP2) program.

In 2008, the MSP2 program set a goal of making the Labs a Zero Waste facility by 2025. The initiative applies only to non-hazardous solid waste, which is typical office waste, and covers the life cycle of materials from the purchase, use, and final disposal of items.

The goal uses the US Zero Waste Business Council performance metric that defines businesses and communities as successfully achieving zero waste when it realizes more than a 90 percent diversion of waste from landfills and incinerators. Methane gas is generated as waste decomposes. Landfills are the third-largest source of methane emissions in the United States, according to a 24-year emissions inventory report published by the US Environmental Protection Agency in 2016, and, in 2013, accounted for about 10 percent of all US greenhouse gas emissions.

Clean city, clean site

"At the time we chose our goal of zero waste by 2025, the city of Albuquerque had set a goal of zero waste to the landfill by 2030," says MSP2 program coordinator Ralph Wrons (4144). "This is when we updated our program's vision statement to include that Zero Waste promotes and integrates materials sustainability into all Sandia operations. Since Sandia hauls all of its office trash to the city of Albuquerque landfill, our goal, in turn, assists the city in reaching its goal. We also use several local recycling vendors and one compost facility operator for the diversion of our waste."

It's not just about fostering a waste-conscious community; it's about impacting DOE sites across the board.

"Coincidentally, this past year DOE updated its annual Strategic Sustainability Performance Plan, which followed up on a presidential executive order, and it outlined some net zero goals in terms of energy, water, and waste. There are different goals for the federal government by 2025 but it turns out we are right in line with the zero waste goals. When we established the goal for the New Mexico site, we were definitely ahead of DOE and what they were indicating at the time," says Ralph. By establishing a Zero Waste program prior to the release of DOE's plan, Ralph says Sandia is able to identify best practices for waste diversion and share that information with other NNSA sites that may be just starting programs.

"Setting a goal and striving for zero waste is in line with Sandia's commitment to service and to shaping a waste-free future by setting the standard and leading by example," says Div. 4000 VP Michael Hazen.

Sizeable solids

Between 2009 and 2012, the MSP2 program made improvements to existing recycle streams and added multiple others, added compost collection points in the cafeterias, and introduced zero waste events at catered functions, such as Take Our Daughters and Sons to Work Day/Earth Day. Team members also attended workshops to learn more about zero waste concepts and how to implement them.

After reaching a plateau in diversion in 2014, the MSP2 program began work on its own strategic plan to understand current types and trends of waste across the Labs and how members of the workforce can compost, reduce, reuse, or recycle those materials to divert waste from a landfill.

Sandia's baseline is 1,048 metric tons of waste, the amount of waste sent to the landfill in fiscal year 2008. In 2015, 761 metric tons of waste were generated, down 27 percent from 2008 and staying on schedule for a zero waste 2025 goal of 90 percent reduction. In 2015,

Div. 4000 Zero Waste Audit

This month, MSP2 team members performed a Zero Waste Audit of the Div. 4000 vice president's office suite, which focused on the Zero Waste Office Principles. "We had a great Zero Waste Audit and learned a lot," says Div. 4000 VP Michael Hazen. The team is committed to reducing waste and ensuring our actions and behavior support reducing, reusing, and recycling. The 3 pounds per week per person gives us a starting point of more than 1,700 pounds a year. We'll get this to zero well before 2020."

Positive highlights:

- Washable mugs and towels
- Sharing a shredder with the department next door
- Shopping at Reapplication
- Filtered water at the sink
- Paperless traveling by the VP
- 100 percent electronic filing

Opportunities found:

- Learn how to use secure printing on the networked copier/printer
- Purchase 100 percent recycled content copier/printer paper
- Excess trash and recycle bins were removed
- More plastic types are recyclable than suite occupants knew

Total estimated waste*

- Less than 3 pounds/person/week
- *represents an initial estimate and will be validated at a later date

members of the workforce reused, recycled, or composted 67 percent of the potential non-hazardous solid waste destined for the landfill, says Sam McCord (4144), an environmental technical planner. Members of the workforce currently average 3.8 pounds of waste per week per person. The goal is to reduce that average to 2 pounds per week by 2020 and to 1 pound per week by 2023.

"If Sandia is able to achieve a 90 percent or higher reduction rate by 2025 — determined from the baseline numbers in 2008 — we'll be at one-half of a pound of waste per person per week," Sam says.

Based on multiple waste assessments conducted in 2015 by



the MSP2 program, with help from Custodial Services, 59 percent of Sandia's solid waste was paper — 28 percent mixed paper, 13 percent paper towels, 10 percent white paper, and 8 percent cardboard. "That's close to 1 million pounds of paper, whether junk mail, microwave lunch boxes, copy paper, boxes, or bathroom paper towels," says Sam. Aside from composting bathroom paper towels, an option currently only available to 10 percent of the workforce based on their building location outside of the limited areas, members of the workforce have a direct impact on what does and doesn't make it in recycling bins.

- Recent EPA data suggests that recycling 1 ton of paper would:
- Save the energy equivalent of 165 gallons of gasoline
 - Save enough energy to power the average American home for six months
 - Save 7,000 gallons of water
 - Save 3.3 cubic yards of landfill space

A partnership among organizations

The MSP2 program has worked with numerous organizations to make the zero waste goal possible. Volunteers assisted in collecting recyclables, auditing waste around the campus, and making employees aware of the impacts they have on reducing, reusing, recycling, and buying green, Ralph says.

In addition to volunteers, members of Custodial Services have become a vital part of Sandia's recycling efforts.

"The custodial department agreed to pilot having custodians manage mixed paper inside buildings and moving it to dumpsters located outside. This was previously done by volunteers but the custodial support makes the process routine and efficient," says Sam.

Recycling as a last option

Reducing waste is actually the first — and cheapest — way the workforce can help, says Sam. Sandia is migrating away from personal and small networked printers, opting instead to use multifunction copiers that can print, scan, and fax documents. This will reduce electronic scrap in the future, and provide immediate savings on equipment, electricity, and supplies such as paper through default duplex printing.

Ralph says organizations have been receptive to feedback on how to reduce waste in their offices and, in June 2015, leaders in Center 3600 reduced the biweekly *Lab News* print run by approximately 30 percent to correspond with a new, more efficient distribution system.

After reducing, reusing materials or products is the next best option. There are many different ways to reuse. Sandia has a website for personnel to post ads for excess or wanted items. Members of the workforce also are encouraged to visit the Reapplication Store to find office items before ordering them. These efforts save Sandia hundreds of thousands of dollars per year in purchases and greatly reduce waste.

When your materials or products are no longer usable, recycling may be an option. The net result of recycling is that the constituent materials are broken down and used as the feedstock in new material or product manufacturing.

One person can make a difference

Just as it takes more than one person to generate the waste, it will take more than one to reduce it.

Zero Heroes can be found throughout the Labs — engaging other members of the workforce and promoting discussions about composting, reducing, reusing and recycling materials to get the Labs get to zero waste by 2025 — but not everyone has to be a Zero Hero, says Ralph. They just have to do their share to help out, he says.

"Minor changes by 10,000 people at Sandia can make major waves," says Sam. "We want Sandians to join the wave of change."



Changes from the Top Down

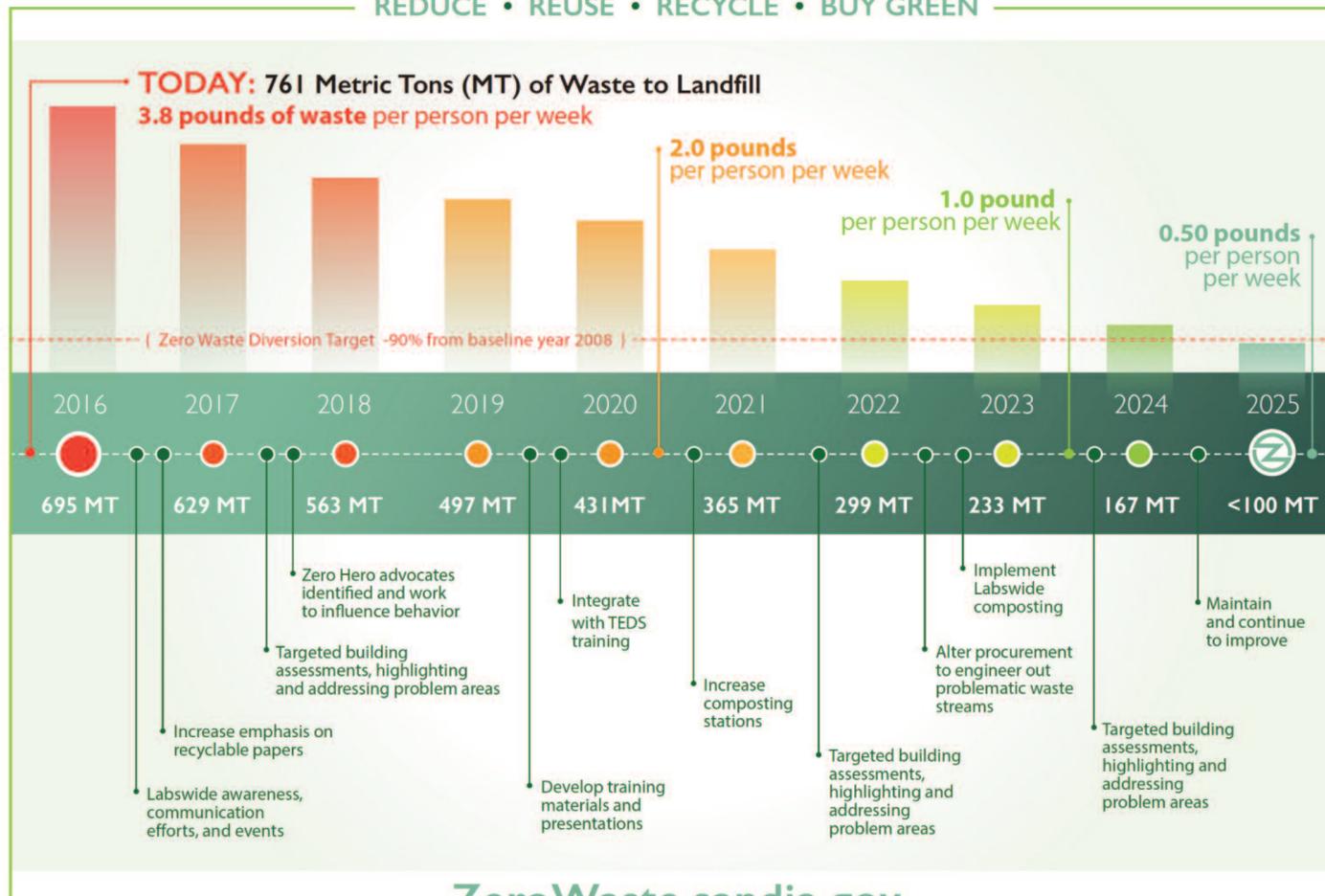
The MSP2 program is asking members of the workforce to share their passion for environmental change by submitting stories, articles, and videos that can help inform and educate others. Submissions can be made on the Zero Waste homepage at <https://zerowaste.sandia.gov>, where additional Zero Waste campaign information and ideas to help reduce waste around the Labs is also available.

Members of the workforce who are unsure of how to dispose of certain items or who need recycling bins for their offices can get in touch with the Solid Waste Collection and Recycling Center by filling out recycling request form at <https://zerowaste.sandia.gov/resources>.



SANDIA'S JOURNEY TO ZERO WASTE

REDUCE • REUSE • RECYCLE • BUY GREEN

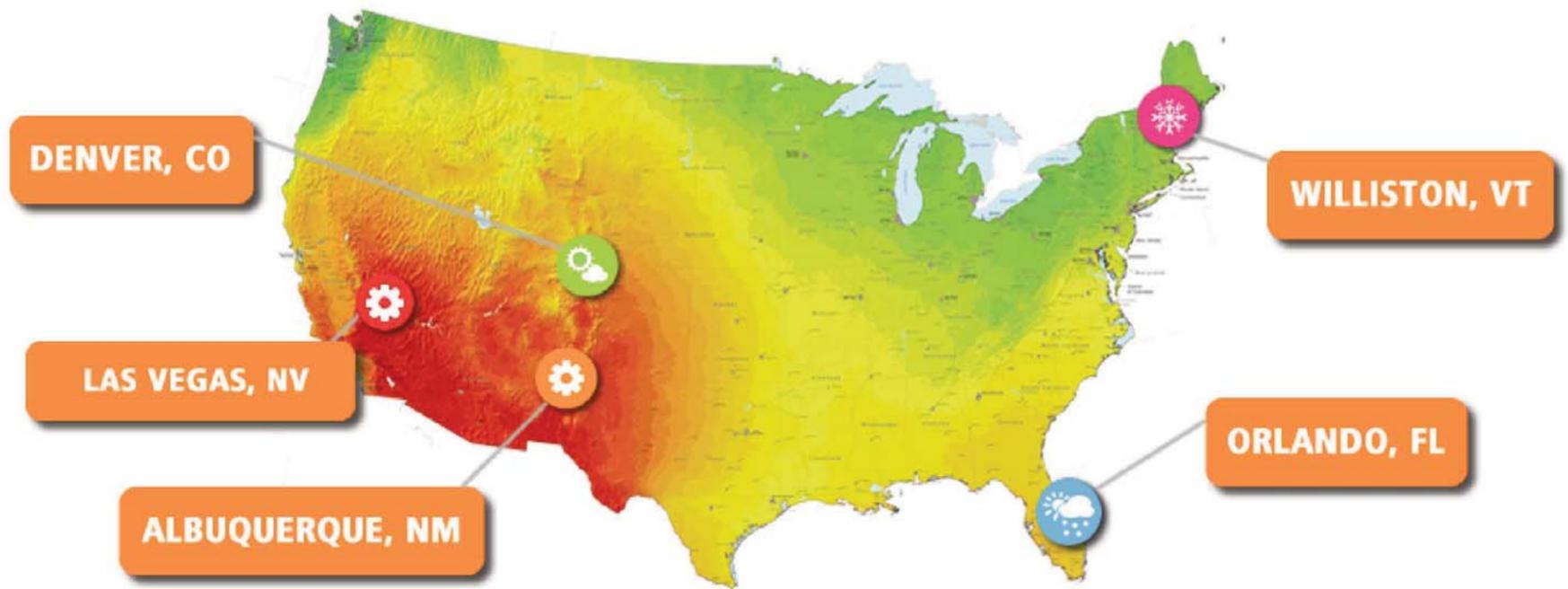


ZeroWaste.sandia.gov



UNDER THE SUN

A Five Test-Center Network



The RTCs—by demonstrating that products perform as predicted over time and under different climatic conditions—strengthen the bankability of emerging technologies, and help drive the market penetration of smarter, more efficient systems.

Sandia tapped again to lead nationwide solar evaluation centers

By Nancy Salem

Sandia won a three-year DOE contract to continue managing the US Regional Test Centers (RTCs), a network of five sites across the country where industry can assess the performance, reliability, and bankability of solar photovoltaic (PV) technologies.

The program currently has more than 12 industry partners and 300 kilowatts of PV installed in different stages of development.

“These centers are helping demonstrate that products perform as predicted over time and in different climates, strengthening the bankability of emerging technologies and driving the market penetration of smarter, more efficient solar systems,” says Joshua Stein (6112), who heads the RTC program.

The program was launched at Sandia and at the National Renewable Energy Laboratory in Denver in fiscal year 2012 and is funded by the DOE SunShot Initiative, which seeks to make solar energy cost-competitive with other forms of electricity by the end of the decade. The number of sites has grown from three to five, in New Mexico, Colorado, Nevada, Florida, and Vermont.

The RTCs collect data — managed through a common database — from PV and concentrated PV systems installed on site to develop a comprehensive set of processes, standards, and guidelines to validate performance and reliability; demonstrate the investment-worthiness of new products and accelerate their adoption; and establish a technical basis for bankability. Bankability is a measure of a project’s risk to an investor; the lower the risk the more bankable it is, resulting in lower cost of capital for new projects.

The centers also quantify the impact of climate on PV technologies and systems, and provide a research platform for emerging technologies, spurring technical innovation in the solar industry. “We provide advanced monitoring and improved performance prediction capabilities for new technologies being introduced to the market,” Joshua says.

Standardized, system-level protocols

The RTCs bring a system-level approach to the PV evaluation landscape, unlike more typical testing that assesses a

single solar module, or panel. The RTCs study groups of panels that make up the PV arrays that generate solar electricity. “The lack of consistent methods and equipment at different labs increases uncertainty,” Joshua says. “We’re developing standardized system-level protocols. We do everything the same at each of the sites in a range of climates. Very few can evaluate at the system level across climates with such consistency. That’s one of the gaps we’re trying to fill with the RTCs.”

The centers use national laboratory expertise in performance modeling, systems reliability, and data analysis. Sandia has a history of measuring and modeling performance of PV systems at levels from about 100 watts to 50 kilowatts, the kinds of systems found on residential rooftops and small businesses.

Approach customized for each partner

The centers are designed to help mainly US industry partners, ranging from module and inverter manufacturers to balance-of-system innovators, improve their technologies and carve out an advantage in the PV marketplace. Partners, who are selected through a proposal process, use their own equipment and contribute cost-sharing for the testing and analysis services.

The approach is customized for each partner and typically involves a three- to five-year field study at multiple sites with quarterly or semiannual reports. Partners receive valuable performance and reliability data for PV products collected from a range of climates and produced and analyzed by national labs.

The program is evaluating cutting-edge and prototype technologies including:

- High-efficiency c-Si PV solar cells and modules for such companies as SolarWorld of Hillsboro, Oregon; Silevo of Fremont, California; and SunPower of San Jose, California
- Module and submodule power electronics, which can increase energy production under partially shaded conditions, for Maxim Integrated of San Jose and Chilicon Power of Los Angeles
- Bifacial modules that allow light to enter from both sides, for Prism Solar of Highland, New York; SolarWorld; Silevo; and SunPower
- Thin-film PV technologies that can be produced at very low cost, for Stion of Menlo Park, California
- Module coatings for antireflection and self-cleaning, for ENKI Technology of San Jose
- Solar resource assessment technology, for Renewable NRG Systems of Hinesburg, Vermont

“These centers are helping demonstrate that products perform as predicted over time and in different climates, strengthening the bankability of emerging technologies and driving the market penetration of smarter, more efficient solar systems.”

— Sandia researcher Joshua Stein

Pre-assembled PV systems

The RTCs are also looking into ease of installation. “We’ve done time and motion studies during installation to quantify how new designs can be implemented more quickly or with less skilled labor, thereby saving money,” Joshua says. “What if we did PV the same way a manufactured home is built in a factory and shipped? A PV system could be assembled on racks off site with just two wires sticking out, driven on a truck, put on the roof, screwed in, and you’re done.” He says RTC partner Norwich Technologies of White River Junction, Vermont, is doing just that, building a PV system in a factory and delivering it to the installation site, aiming to increase quality and lower costs.

“Very few programs like the RTCs exist, allowing manufacturers to test their product and models under such a wide variety of climate and location conditions, and at the same time provide access to an institution like Sandia that has literally written many of the world’s most adopted solar models,” says Randy Stewart, CEO of Prism Solar. “We are very positive about the current work and the far-reaching goals the collaboration will bring.”

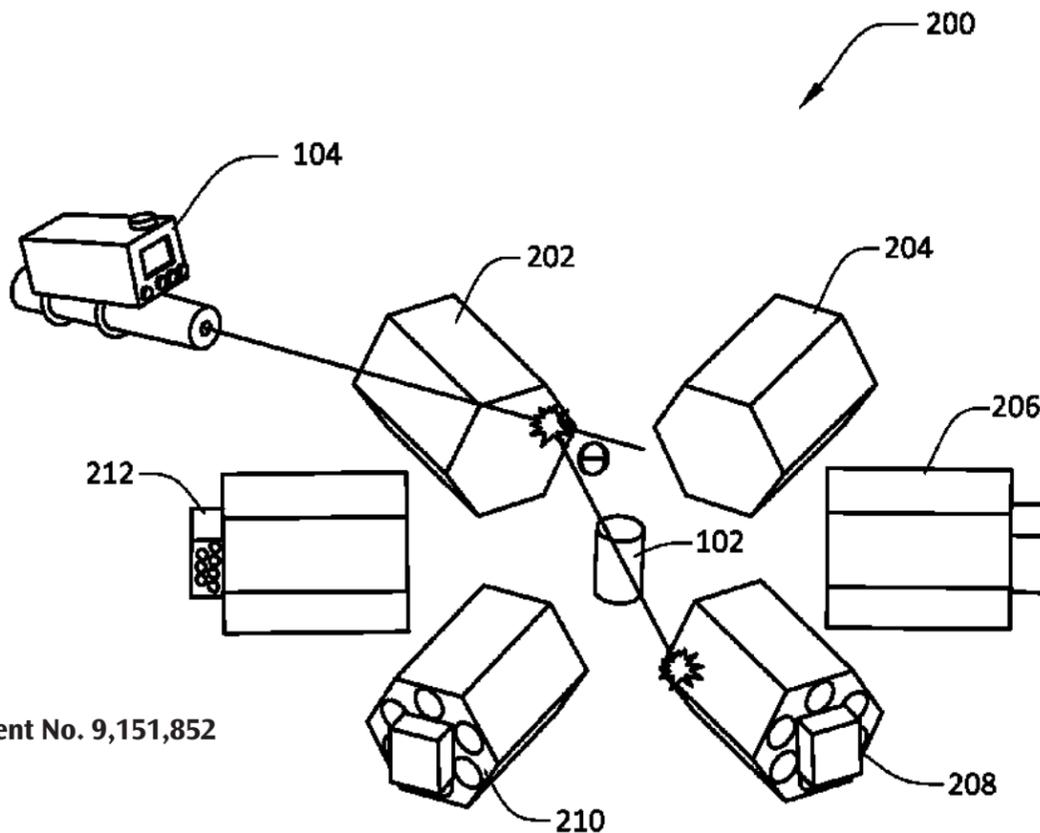
Mukesh Dulani, US president of SolarWorld, says the program supports manufacturers who want to provide “exactly the renewable-energy products that consumers want.”

Powered by
SunShot
U.S. Department of Energy

Recent patents

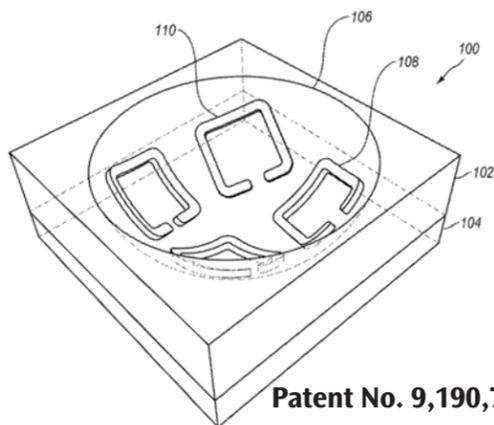
Note: Patents listed here include the names of active and retired Sandians only; former Sandians and non-Sandia inventors are not included. Following the listing for each patent is a patent number, which is searchable at the US Patent and Trademark Office website (www.uspto.gov).

Peter Marleau (8127): **Material Identification Based upon Energy-Dependent Attenuation of Neutrons.** Patent No. 9,151,852.



Patent No. 9,151,852

Dulce C. Hayes (1714), Ronen Polsky (1714), David R. Wheeler (5964), and Jason C. Harper (8631): **Multifunctional Thin Film Surface.** Patent No. 9,157,161.
 Jeromy Hollenshead (5417) and Leonard E. Klebanoff (8367): **Methods and Apparatus for Cleaning Objects in a Chamber of an Optical Instrument by Generating Reactive Ions Using Photon Radiation.** Patent No. 9,156,068.
 Tina M. Nenoff (1100) and Dorina Florentina Sava Gallis (1124): **System and Method for the Capture and Storage of Waste.** Patent No. 9,162,914.
 John F. Klem (1766): **Interband Cascade (IC) Photovoltaic (PV) Architecture for PV Devices.** Patent No. 9,166,084.
 Mark S. Derzon (1719), Paul C. Galambos (1719), and Ronald F. Renzi (8625): **Compact Ion Chamber Based Neutron Detector.** Patent No. 9,170,340.
 David Bruce Burckel (1765), and Gregory A. Ten Eyck (2241): **Fabrication of Small-Scale Structures With Non-Planar Features.** Patent No. 9,190,736.



Patent No. 9,190,736

Anthony L. Lentine (1765) and Justin R. Ford (5634): **Intelligent Electrical Outlet for Collective Load Control.** Patent No. 9,172,245.
 Yifeng Wang (6222), Jessica Nicole Kruichak (6222), and Charles R. Bryan (6225): **Methods of Capturing and Immobilizing Radioactive Nuclei With Metal Fluorite-Based Inorganic Materials.** Patent No. 9,180,428.
 Paul T. Vianco (1831) and Alex L. Robinson (2632): **Passive Absolute Age and Temperature History Sensor.** Patent No. 9,182,436.

Todd M. Alam (1853): **Biological Detector and Method.** Patent No. 9,194,921.
 M. Kathleen Alam (2555), Laura E. Martin (2555), David Alexander Jones (2555), and Peter J. Hotchkiss (6824): **Trace Detection of Analytes Using Portable Raman Systems.** Patent No. 9,194,805.

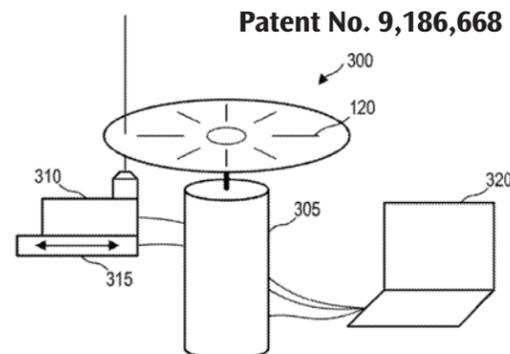
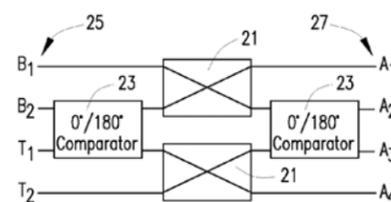
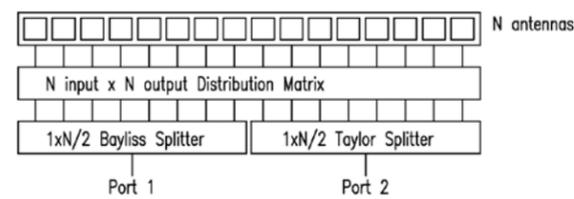


Figure 3

Eric Langlois (1719) and Paul J. Resnick (1719): **Fully Integrated and Encapsulated Micro-Fabricated Vacuum Diode and Method of Manufacturing Same.** Patent No. 9,202,657.
 Roy H. Olsson (1719), Travis Ryan Young (1745), Michael David Henry (1746), and Karl Douglas Greth (5642): **Tuning Method For Microresonators and Microresonators Made Thereby.** Patent No. 9,203,134.
 Anup K. Singh (8620) and Anson Hatch (8621): **Microfluidic Devices and Methods Including Porous Polymer Monoliths.** Patent No. 9,201,069.
 Scott C. Lindblom (2152) and Frank J. Maldonado (6622): **High Temperature Charge Amplifier for Geothermal Applications.** Patent No. 9,209,766.
 Julia M. Craven (5772): **Athermal Channeled Spectropolarimeter.** Patent No. 9,207,123.
 Jeffrey P. Koplow (8366): **Heat Exchanger Device and Method for Heat Removal or Transfer.** Patent No. 9,207,023.
 Ronen Polsky (1714), Dulce C. Hayes (1714), Shawn M. Dirk (2241), David R. Wheeler (5964), and Jason C. Harper (8631): **Method for the Electro-Addressable Functionalization of Electrode Arrays.** Patent No. 9,212,430.
 Jason Hamlet (5627) and Jackson Mayo (8953): **Approximate Circuits for Increased Reliability.** Patent No. 9,218,444.
 Darwin K. Serkland (1764) and Bion J. Merchant (5752): **In Situ Calibration of a Light Source in a Sensor Device.** Patent No. 9,222,810.
 Bernd H. Strassner II (5345): **Delivering Both Sum and Difference Beam Distributions to a Planar Monopulse Antenna Array.** Patent No. 9,219,317.



Patent No. 9,219,317

Hongyou Fan (1815): **Tuning and Synthesis of Metallic Nanostructures by Mechanical Compression.** Patent No. 9,180,420.
 Edward I. Cole Jr. (1000): **Power Spectrum Analysis for Defect Screening in Integrated Circuit Devices.** Patent No. 9,188,622.
 Ting S. Luk (1131): **Photovoltaic Cell With Light Trapping for Enhanced Efficiency.** Patent No. 9,190,542.
 William C. Sweatt (1516): **Solar Photovoltaic Reflective Trough Collection Structure.** Patent No. 9,190,546.
 Robert L. Jarecki Jr. (1746), Robert L. Bauer (1746), John Teifel (1754), and Subhash L. Shinde (6123): **Three-Dimensional Stacked Structured ASIC Devices and Methods of Fabrication Thereof.** Patent No. 9,190,392.
 Paiboon Tangyonyong (1755): **Power Spectrum Analysis for Defect Screening in Integrated Circuit Devices.** Patent No. 9,188,622.
 Igal Brenner (1765): **Photovoltaic Cell With Light Trapping for Enhanced Efficiency.** Patent No. 9,190,542.
 Hongyou Fan (1815): **Tuning and Synthesis of Semiconductor Nanostructures by Mechanical Compression.** Patent No. 9,187,646.
 David Bossert (5783): **Imaging Doppler Lidar for Wind Turbine Wake Profiling.** Patent No. 9,188,677.
 Mark J. Monda (6532), Clinton G. Hobart (6532), Thomas S. Gladwell (6532), and Justin Garretson (6631): **Automatic Tool Alignment in a Backscatter X-Ray Scanning System.** Patent No. 9,186,116.
 Anup K. Singh (8620): **Microfluidic Devices, Systems, and Methods for Quantifying Particles Using Centrifugal Force.** Patent No. 9,186,668.
 Ines Montano (1117) and Andrew A. Allerman (1126): **High Extraction Efficiency Ultraviolet Light-Emitting Diode.** Patent No. 9,196,788.

Recent Retirees



New Mexico photos by Michelle Fleming



Mike Tebo
27 5555



Sue Phelps
26 5785



Frank Lujan
23 10597



Dan Curry
15 3653



Karl Braithewaite
10 120

Mileposts



New Mexico photos by Michelle Fleming



David Bullington
40 2665



David Samuel
40 2997

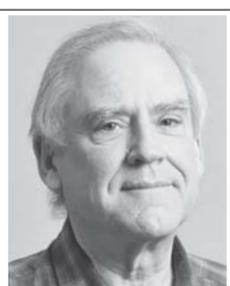


Jeanne Lewis
35 2124

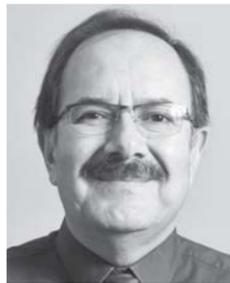
Recent Retirees



New Mexico photos by Michelle Fleming



Billy Brock
38 5345



Anthony Montoya
35 2224



David Cocain
30 2244



Emily Baca
25 6200



Ted Blacker
25 1543



Matthew W.K. Brown
25 2622



Richard Ormesher
30 5332



Grace Thompson
30 256



David Garcia
25 4237



Rita Gonzales
25 2620



Norma Lauben
25 9546



Nisa Brown
20 415



Jocelyn De Luche
20 2727



Ken Moreland
20 1461



Alan Williams
20 1543



Julia Baca
15 435



George Bachand
15 1132



Rita Betty
15 1911



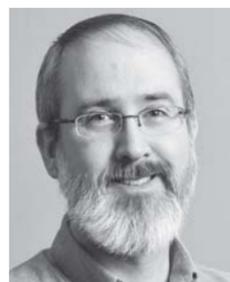
Jamie Cash
15 1384



Kevin Crown
15 6632



David Dapolito
15 4844



Brice Fisher
15 5568



Kristin Flores
15 10610



Joseph Garde
15 6623



Gerry Giese
15 9525



Lanny Gilbertson
15 9523



Debbie Griego
15 2993



Teklu Hadgu
15 6222



Everett Hafenrichter
15 2553



Lisa Ice
15 9326



Drew Johnson
15 1674



Adriane Littlefield
15 6832



Sheree Mann
15 5324



Juanita Marker
15 2981



Charles Rhett Martin
15 5965



Stephen Meserole
15 1816



Amy Moy
15 1756



Cristina Munro
15 2952



Chuck Nove
15 5637



Daniel Peterson
15 2613



Alex Robinson
15 2632



Matt Sceiford
15 1657



Frank Whiston
15 2221

SANDIA CLASSIFIED ADS

MISCELLANEOUS

CHARITY GOLF TOURNAMENT, benefits charter school, May 14, Arroyo del Oso, register at www.coralcharter.com. Kotula, 505-400-4690.

SIGNED BOB LEE PRINT, "The O Bar O Crew," 139/950, beautiful framing, 28" x 35", \$750. Dotson, 803-6179.

MOUNTAIN HARDWEAR AGAMA PACK, \$60 OBO; North Face Oryx backpack, \$100 OBO; both in excellent condition. Poulter, 505-503-9803.

ELLIPTICAL, NordicTrack ASR 630, extremely quiet, hardly used, excellent condition, \$150. Peterson, 505-859-3715.

LAPTOP, 2013 MacBook Pro, like new condition, \$700; 2014 custom Deity Cryptkeeper dirt jumper mountain bike, \$800. Russell, 505-917-3911.

CABINET, black hardwood, w/sliding glass doors, 32"W x 34"H, 12"D, can email photo, \$75. McDonald, 505-554-2048.

NEW MEXICHORDS BARBERSHOP EXTRAVAGANZA, May 21, call for tickets & show times. Taylor, 242-4451.

WEDDING GOWN, Mikaela, style 1802, unworn, size 10, sample, MSRP, \$2,000, asking \$1,000 OBO. Godsey, 918-906-7523.

DLP TV, Mitsubishi, 82-in., WD-82740, low lamp hours, \$700 OBO. Lujan, 299-2218.

GAS DRYER, Maytag Neptune, easy load, large capacity, like new, \$75. Vigil, 575-386-6377.

KID CARRIER BACKPACK, Deuter Kid Comfort III, excellent condition, \$150 OBO. Verley, 221-7827.

LAWNMOWER, gas, Toro, w/Recycler 22', used one season, paid \$400, asking \$250; 83-in. double sink bathroom vanity, linen white, marble top, warm white, brand new, \$1,800 OBO. Low, 505-379-0441.

REAR PROJECTION TV, JVC, 55-in., \$150; dark wood toddler bed, \$20; solid wood distressed armoire, \$150. Ulibarri, 505-350-1810.

POPEJOY TICKETS, Jim Belushi/Comedy, May 1, 3 p.m., 2, \$50 ea.; Disney's Newsies, June 24, 8 p.m., 4, \$54.50 ea. Kelly, 299-3527.

FIREFLY FANS, original Serenity movie poster, never used, mint condition, \$20. Stubblefield, 263-3468.

BARSTOOLS, 3, leather, wrought iron, 29-in. seat height, \$200 ea.; cabinets & countertops, kitchen & bath, w/sinks & faucets, \$1,500; prints on canvas, 2, Italian landscapes, 48" x 48", unframed, \$100 ea. Rice, 332-1060.

DINING ROOM SET, large, 9-pc., upholstered seats, leather backs, 2 leafs, stunning, excellent condition, \$1,500. de la Fe, 903-0717.

FUTON, queen, oak, w/2 matching footstools, Southwestern covers, rarely used, \$400; TEMA upright dresser, teak, 4 drawers, \$100. Phelan, 505-717-2468.

EVAPORATIVE COOLER, Mastercool CHC631, single inlet, \$250; Lennox G60UHV gas furnace, \$275. Thompson, 505-292-2877.

GENERATOR, Robin (FUJI Industries), 600W, AC/DC, portable, 40 lbs., <200 hrs., \$250. Murphy, 797-8779.

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.

WEDDING DRESS, heart-shaped, strapless, princess-style, w/corset back, size 2, beautiful, never worn/altered, w/tags, \$1,000 OBO. Montoya, 505-589-9985.

TRANSPORTATION

'16 HONDA CIVIC EX, heated seats, rear camera, 1,800 miles, perfect condition, \$20,000 OBO. Siegel, 505-307-3158, leora50@comcast.net.

'15 SUBARU WRX LIMITED, 6-spd. manual, loaded, white, 15K highway miles, excellent condition, \$27,800 OBO. Horton, 280-4202.

RECREATION

CANOE, 16-ft., red Royale Old Town Camper, barely used, w/2 paddles. Canaris, 505-889-3706.

'04 HARLEY-DAVIDSON VROD, \$5,500. Vigil, 505-363-5106.

'05 SUZUKI DL1000, V-Strom Adventure Touring style, dark blue, extras & upgrades available, great fun. \$4,000. Myers, 505-217-5812.

'06 CROSSROADS CRUISER M-26 R, w/14' x 5' utility trailer & 5th wheel generator, \$15,500. Bethke, 505-463-6641.

KAYAKS, 2, Wilderness Systems Pungo 140, complete, skirts, paddles, life vests, roof rack, \$1,000. Logan-Condon, 505-218-1310.

'07 BMW R1200GS MOTORCYCLE, tank bag, Vario side cases, heated grips, <10K miles, excellent condition, \$8,500. Muller, 505-836-9687.

REAL ESTATE

4-BDR HOME, 2 baths, 2,093-sq. ft., den w/fireplace, garage, granite counters, refrigerated air, 98th & Ladera, \$245,000 OBO. Sanchez, 505-515-5997, ask for Joseph.

3-BDR. HOME, 1-3/4 baths, 1,930-sq. ft., fully remodeled, move-in ready, private/wired hot tub area, Eubank/Academy, \$270,000. Williams, 505-379-8994.

3-BDR. HOME, 2 baths, 1,800-sq. ft., complete remodel, maple cabinets, quartz counters, farm sink, fireplace, new tile/carpet, new windows/stucco, Taylor Ranch area. Ryfun, 505-271-7795 or 505-414-0937.

4-6 BDR. HOME, great for large family, multi-generation, sandwich generation, Open May 1, MLS#858758. Baczek, 505-450-7895.

WANTED

MOVING BOXES, small & medium. 505-990-9116, ask for Steve.

CAT SITTER, near Academy & San Mateo, ~May 3-June 6. Molina, 823-2013.

ROOMMATE, share home, minutes from open space, \$500/mo., call for details. Harms, 713-775-6114.

HOUSEMATE, new Volterra neighborhood near Sandia, 2nd master available, \$420/mo. plus utilities. Delgado, 505-917-7090.

Sandia in 3-D Challenge 1 wraps up, Challenge 2 launches

By Mollie Rappe

Sandians from across the Labs gathered April 7 to celebrate the close of the first round of the Sandia in 3-D Challenge and hear the categories for the second round.

Of the 38 teams originally registered for Challenge 1, 23 submitted additively manufactured improved designs, musical instruments, and Sandia swag.

Mark Smith (1830), deputy director of additive manufacturing, says, "One of the major goals of this whole activity was to promote awareness of additive [manufacturing] and also to promote networking within Sandia and I think we've really succeeded admirably. I can't tell you how excited I am to see some of the creativity that came out of all this."

Team M3DL — Penny Moore (1747) and Christina Dallo (1768) — took first in the Improve an Existing Design Challenge with their silicon wafer pressure bonding tool.

The Prints of Persia — Craig Hokanson (8943), Andrew Miller (9539), and Ruth Schwarz (9539) — won the Musical Instrument Design Challenge with their self-harmonizing flute.

Bonnie Antoun (8343), the Sandia in 3-D lead, says she didn't anticipate that the Sandia Swag Design Challenge



SANDIA IN 3-D New Mexico participants proudly display their submissions and 3-D printed trophies with Mark Smith, deputy director of additive manufacturing (far right).

(Photo by Mollie Rappe)



would be so popular, with almost 80 percent of the teams competing in that category. Bimodal Link — Tim Sa (8114), Mikhail Shashkov (8954), Stephen Mueller (8114), and Ann Yoshimura (8118) — took first in that category with a puzzle bank.

With 19 percent of the vote, Team One — Patrick Munoz (10657), Vincente

Garcia (3653-2), Mary Jo Baucom (9300), Jon Abbott (2722), and Zuzana Patterson (2722) — won the Viewer's Choice award for their cell phone/tablet holder decorated with symbols for Sandia's seven mission areas.

Denise Pauler (414) worked on a pen and pencil holder with a secret M&M compartment. She and her teammate placed third in New Mexico in the highly contested Sandia Swag Design Challenge and fourth overall in the Viewer's Choice awards. Denise says, "It was a pleasant surprise that we got third. I learned a lot during the process."

Her teammate Grant Wells (414) says, "The Sandia in 3-D challenge gave us the opportunity to do something technical. We would like to do round two, if we have enough time."

Challenge 2 will include a second round of Improve an Existing Design, a Puzzle Design Challenge, and an Awards Design Challenge. New teams are welcome for the second and third rounds. First round teams can stay together or add new team members, says Bonnie.

Participants may charge up to 32 hours to Strategic Education Initiative (TRC291), with prior manager approval. For more information or to register for the second challenge visit the Sandia in 3-D wiki tiny.sandia.gov/s3d.



Cold War Warriors:

the story of Sandia's decades in nuclear field testing

By Sue Major Holmes

Sandia video producer Myra Buteau sweeps her hand toward the top shelf of a bookcase stuffed with black cases of high-definition tapes. The biggest challenge in telling the story of Sandia's years of work in above-ground and underground nuclear field tests, she says, was condensing the 100 hours of interviews on those tapes into a 32-minute historical documentary.

"Cold War Warriors" traces nuclear weapons field testing from the first nuclear detonation in southern New Mexico in 1945 to the US moratorium on nuclear testing in 1992. Myra (3653) narrates, but the story is largely told by 44 Sandia field testers, the people she calls "game changers in the evolution of nuclear weapons testing."

"I wanted to create a documentary that not only showed the significance of their contributions but also gave the essence of who these nuclear weapons field testers were," she says.

The film opens with a montage of historical photos and documents and progresses into interwoven interviews about nearly 50 years of nuclear tests in New Mexico, Pacific Islands, and the Nevada Test Site, now the Nevada National Security Site. It includes old footage of tests and the political events that shaped the era. Myra calls the field testers



MYRA BUTEAU



"behind-the-scenes heroes on the world stage during a frightening time in American history known as the Cold War."

"It's important for people to see the legacy of the Labs and the people who built that legacy," she says. "I really wanted to pay tribute to the individuals who dedicated their lives, who had such a passion for this work, and to the families. There were a lot of stories of people who'd go away to testing and they'd be gone three weeks, four weeks, five weeks. It was a huge effort."

Finding the guys who were there

The first interview shown is with the late Ben Benjamin, who teases that the filmmakers really wanted J. Robert Oppenheimer or Gen. Leslie Groves, the men who headed

Photos from Cold War Warriors documentary

the Manhattan Project that built the first atomic bomb. But they died decades ago, forcing the interviewers to go down a list until "you finally got to a technician who was there, and that was me."

Myra says in the documentary, Ben "epitomized the field test, the can-do attitude, the esprit de corps mindset, and the get-the-job-done motto."

The idea for the program came from David Thompson, former manager of the Nevada Test Site, who suggested capturing the recollections of those behind the nuclear tests. He turned to then-Sandia President Tom Hunter, who backed the idea. Thompson tapped Myra to put the documentary together. The project took a decade and countless people across the Labs — from the historian and archivist to people in testing and nuclear weapons groups, knowledge preservation, digital streaming, and classification, she says.

Field tester Al Chabai, now retired, suggested many of the people interviewed and conducted most of the conversations. Al, who also appears in the documentary, worked in the testing program for decades. "He was the perfect choice," Myra says. "He knew the people because he worked with them. I did some of the interviews, but I just didn't have the knowledge to ask the questions that he knew to ask."

She began editing by paring the interviews to the most striking nuggets, then wove those clips into a chronological story with a natural flow. "When you interview people on certain topics they'll say very similar things, and then it's easy to cut back and forth," says Myra, a Sandia video producer/director for two dozen years. She introduced the documentary when it was shown at an April 25 Tech Symposium.

Those who lived it have passion for the story

Her previous work in everything from Weapon Intern Program graduation ceremony videos to an early career in television and radio taught her "people can tell a story better than I could ever script it, and they have passion and the emotion."

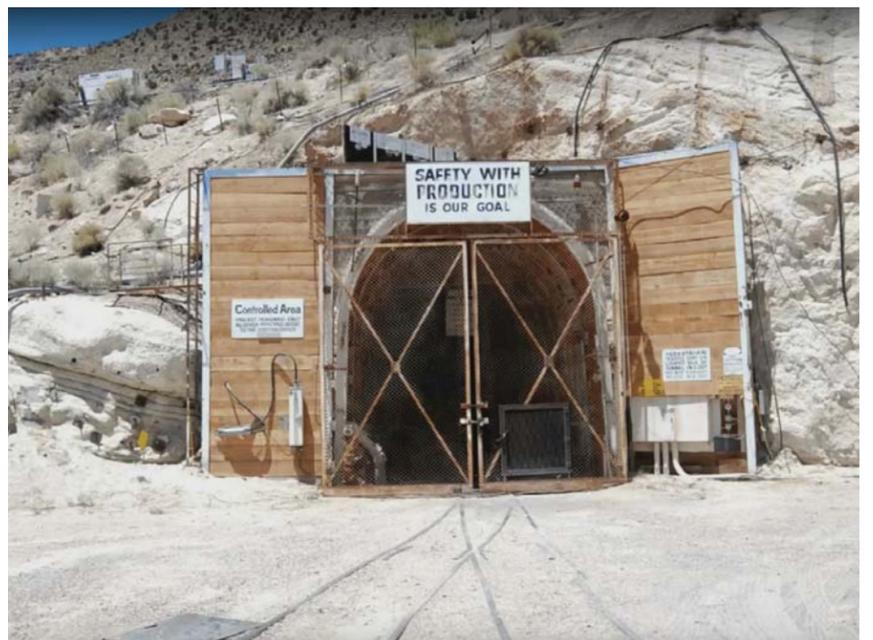
The budget was limited, so she decided to begin by talking to as many field test workers as possible. That took a year. The original list was longer than the 44 eventually interviewed, but there wasn't enough money to film everyone. When the initial budget ran out, there was no funding to edit all the footage and produce the documentary.

"I wanted to get as many interviews done as we could because of the advanced age of some of the individuals,"



Myra says. "I thought that was more important. I thought perhaps sometime in the future we could get more funding to do the editing. Little did I know it would be 10 years."

About 40 percent of those interviewed have since died, she says. "Had we not captured this knowledge, we would not have this historical archive of their stories and what they went through and who they met, what they did."



Documentary made up of 44 interviews

Many people pushed for funding over the years to finish the documentary. Sandia's nuclear weapons knowledge preservation office funded the original edit but not all the interviews made that cut. Myra again turned to the nuclear weapons program for additional funding. "I didn't want to put anything out there that didn't have everybody that we had interviewed," she says.

Myra also wanted the entire interviews and the high-resolution format available in the future, so the original tapes eventually will be housed in the Defense Threat Reduction Agency archives. "I don't want them to go into an abyss where no one has access to them," she says. "I think they're historically important."

She hopes the film gives viewers a greater appreciation for field testing "in the era in which these people lived and worked, which was under the fear of the Cold War. I hope they have a greater appreciation of all that it took to protect our nation and to create a nuclear weapons arsenal."

To view the documentary, go to <https://youtu.be/bCENYSK9qL0>

