



## Don't set it and forget it — scan it and fix it with tech that detects wind blade damage

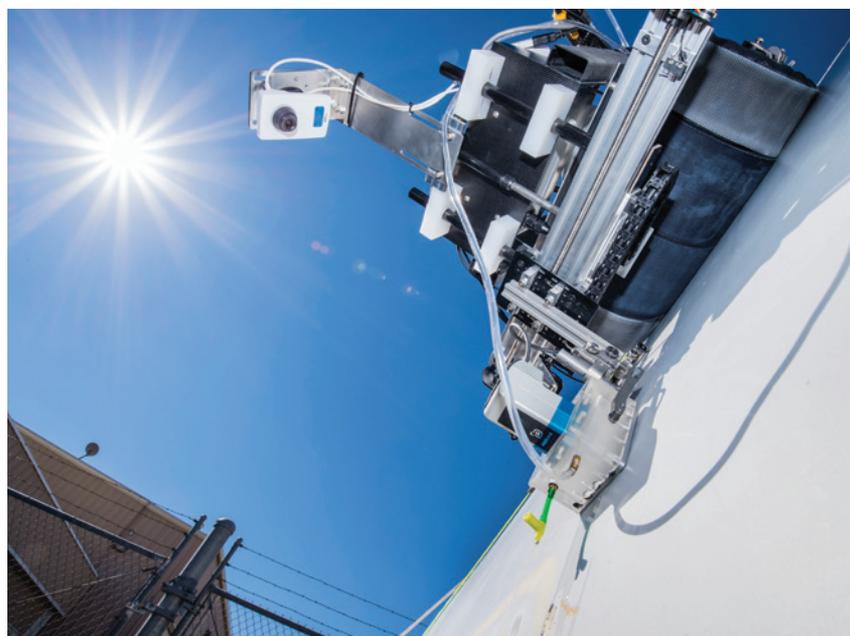
*Sandia's crawling robots, drones detect damage to save wind blades*

By **Kristen Meub**

**D**rones and crawling robots outfitted with special scanning technology could help wind blades stay in service longer, which may help lower the cost of wind energy at a time when blades are getting bigger, pricier and harder to transport, Sandia researchers say.

As part of the Department of Energy's Blade Reliability Collaborative work, funded by the Wind Energy Technologies Office, Sandia researchers partnered with energy businesses to develop machines that noninvasively inspect wind blades for hidden damage while being faster and more detailed than traditional inspections with cameras.

"Wind blades are the largest single-piece composite structures built in the world — even bigger than any airplane, and they often get put on machines in remote locations," said Joshua Paquette, a mechanical engineer in Sandia's wind energy program. "A blade is subject to lightning, hail, rain, humidity and other forces while running through a billion load cycles during its lifetime, but you can't just land it in a hanger for maintenance."



**EYE, ROBOT** — Sandia researchers use crawling robots and drones with infrared cameras to look for hidden wind blade damage to keep blades operational for longer and drive down the costs of wind energy.

Photo by Randy Montoya

Routine inspection and repair are critical to keeping these megablades in service, Joshua said. However, current inspection methods don't always catch damage soon enough.

Sandia is drawing on expertise from avionics and robotics research to change that. By catching damage before it becomes visible, smaller and cheaper repairs can fix the blade and extend its service life, he said.

In one project, Sandia outfitted a crawling robot with a scanner that searches for damage inside wind blades.

In a second series of projects, Sandia paired drones with sensors that use the heat from sunlight to detect damage.

Traditionally, the wind industry has had two main approaches to inspecting wind blades, Joshua said.

The first option is to send someone out with a camera and telephoto lens. The inspector moves from blade to blade snapping photos and looking for visible damage, like cracks and erosion. The second option is similar but instead of standing on the ground, the inspector rappels down a wind blade tower or maneuvers a platform on a crane up and down the blade.

"In these visual inspections, you only see surface damage," Joshua said. "Often though, by the time you can see a crack on the outside of a blade, the damage is already quite severe. You're looking at a very expensive repair, or you might even have to replace the blade."

These inspections have been popular because they are affordable, but they miss out on the opportunity to catch damage before it grows into a larger problem, he said. Sandia's crawling robots and drones are aimed at making noninvasive internal inspection of wind blades a viable option for the industry.

Sandia and partners International Climbing Machines and Dophitech built a crawling robot inspired by the machines that inspect dams. The robot can move from side to side, up

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## Rooftop solar panels get boost from Sandia tool

*New software previews a year on the grid in minutes*

By **Kristen Meub**

**H**omeowners and businesses may now have an easier time getting solar panels on rooftops thanks to software developed at Sandia.

The new software can run a detailed, second-by-second simulation, known as quasi-static time series analysis, that shows utility companies how rooftop solar panels at a specific house or business would interact with a local electrical grid throughout the year.

Utility companies need the analysis because they must deliver electricity at the standard voltage used to run everything from refrigerators to phone chargers. Large amounts of solar generation in one section of a city can lead to extreme voltage fluctuations that can damage household electronics.

This type of grid analysis hasn't been practical outside of research settings until now because previous models took days to run a single scenario. The new simulations are more detailed than those used by utility companies, and Sandia researchers hope they will result in more solar panel installations.

"When installing new solar panels on the grid, utility companies will analyze how a new system interacts with the grid, typically by doing a snapshot, power-flow simulation to determine if the impacts will be OK or not," said Sandia engineer Matthew Reno. "However, doing a snapshot of one instance in time is conservative because of the uncertainty about impacts that happen at various times on solar panels, such as the weather. This can lead to increased connection costs or homeowners living in parts of the city having unnecessarily low limits for adding solar panels, especially in sunny states."

In a three-year project funded by DOE's Solar Energy Technologies Office as part of the Grid Modernization Lab Consortium, Sandia, the National Renewable Energy Laboratory, Georgia Tech University, the Electric Power Research Institute and CYME International, the largest software vendor for utility companies, took a four-part approach to speeding up time-series analyses to learn more accurately how use of solar energy affects the grid.



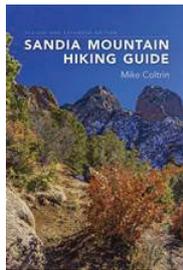
**FASTER SOLAR** — Matthew Reno helped develop new software that performs faster quasi-static time series analyses to show how rooftop solar panels interact with the electrical grid throughout the year.

Photo by Randy Montoya

— CONTINUED ON PAGE 3

## Scientist discovers work-life balance in 'the other Sandia'

By **Mike Coltrin, Retiree**



Going on 40 years ago, I was excited to join Sandia Labs fresh out of graduate school. I was hired into the newly created Laser & Atomic Physics department, with a charter of using these new tools (lasers) to understand

the underlying chemistry in the growth of semiconductor materials. Little did I imagine that this would be my general area of research my entire career at the Labs.

Moving to Albuquerque, I was also immediately drawn to “the other Sandia” that would turn out to be an important part of my life – that is, the Sandia Mountains. Living next door to a real mountain seemed like a dream after having grown up in Oklahoma and going to school in Illinois, two wonderful states that could not be any flatter. Thus, the beginning of a work-life balance at the Labs and in the great outdoors that makes a career at Sandia Labs so attractive still today.

I began venturing into the Sandia Mountains on weekends – admittedly a bit daunted. I soon purchased what was THE authoritative “Hikers and Climbers Guide to the Sandias” (Mike Hill, University of New Mexico Press). Like almost everybody, I started off by hiking La Luz trail, which is one the longest and toughest hikes on the mountain. Whew! So, I literally “turned the page” (of the book) and began trying the dozens of other trails that the Sandias offered. My now well-worn copy of that book has the penciled check-marks next to each of the trails in the table of contents.

Over twenty-some years, I regularly added to my hiking diary, recording my impressions of the trails, approximate distances, time for

the hike, etc. When commercial handheld GPS devices became widely available in the early 2000s, I starting recording a GPS “track” (i.e., the latitude and longitude of the route every 20 feet or so) on every hike.

Yes! Now I had data, and was able to plot out and save the routes that I had taken or save the location of “that spot with the beautiful view” that I had found. Over the years, my weekend avocation of hiking began to take a more technical bent, in keeping with my scientific day job at the Labs.

### Friend of the Sandia Mountains

Around 2004, it so happened that UNM Press was partnering with a volunteer organization named the Friends of the Sandia Mountains to publish a nature guide to flora and fauna in the mountains. “The Field Guide to the Sandia Mountains” would include sections on ecology, fire, geology, flowers, trees, bird, mammals, etc. The publisher wanted to complement this book with a new guidebook for the trails in the Sandias. The author of the earlier hiking guide was no longer available, having moved from the area a number of years prior. The question was: who should write it?

As a member of FOSM, I was known for my love of hiking and my penchant for writing thorough notes on the trails, GPS mapping, etc. That sounds like a Sandian, I’ll admit...

My name was suggested to UNM Press, and in a short period of time I had a contract to write a book. This is not the usual route for a first-time author to get a book published. I was honored to have the opportunity, but a bit overwhelmed at the same time. However, since my position at the Labs included writing technical publications, I hoped that I could do it.

A big unknown on my end was how to produce trail maps to incorporate into the book. Again, an interplay of work and hobby opened up a solution. A few years earlier I had met Barry Roberts, a fellow Sandian, through a common interest in the mountains and in mapping trails using a GPS.

Barry generously offered help in creating contour maps for the book and combining them with the GPS trail tracks that I had recorded over the years. Without his technical expertise in geographic information system mapping technology and advice, I could not have pulled this off. As it turned out, the technical work in creating the maps took just as long as writing the narrative for the new book.



**TRAILBLAZER** — Sandia retiree Mike Coltrin discovered a love of hiking in the Sandia Mountains after moving from the flatter states to work at the Labs. His “Sandia Mountain Hiking Guide” has proved a popular seller in local bookstores for more than a dozen years. Following retirement in 2017, he published a revised and expanded guide. **Photo courtesy of Mike Coltrin**

In the Spring of 2005, my “Sandia Mountain Hiking Guide” was published by UNM Press alongside the field guide. It turned out to be a popular seller. It was in print and sold in local bookstores for more than a dozen years.

But change is inevitable. And so it was with the trail system in the Sandia Mountains. New trails have been added, a few access points and trailheads have closed and important trail reroutes have occurred.

And so it was also with me; I retired from Sandia in early 2017 after a rewarding 37-year career at the Labs. I quickly threw myself, in earnest, at the task of updating and expanding the original edition of the book. This included writing about new trails and adding some new features, like an emphasis on family-friendly outings for hikers of all ages and abilities. I even got to renew some of my technical skills by creating new maps for the book, taking advantage of improvements in GPS technology.

The revised and expanded edition of the “Sandia Mountain Hiking Guide” was published, again by UNM Press, in April of this year, I am now enjoying a more relaxed retirement, hiking in our beautiful mountains. I hope to see you on the trails. 

Managed by NTESS LLC for the National Nuclear Security Administration

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Sandia National Laboratories is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

Published on alternate Fridays by Internal, Digital and Executive Communications, MS 1468

LAB NEWS ONLINE: sandia.gov/LabNews

**EDITOR'S NOTE:** Lab News welcomes guest columnists who wish to tell their own “Sandia story” or offer their observations on life at the Labs or on science and technology in the news. If you have a column (500-800 words) or an idea to submit, contact Lab News editor Tim Deshler at [tadeshl@sandia.gov](mailto:tadeshl@sandia.gov).



**LASER SHARP** — Sandia industrial hygienist Mendy Brown (center) recently accepted the Achievement in Laser Safety Education Award for Sandia from the Laser Institute of America at its International Laser Safety Conference in Kissimmee, Florida. The award recognizes organizations and laser safety program managers for commitment and dedicating significant time and resources to laser safety, having trained laser safety officers and provided ongoing laser safety education. Sandia was one of 10 award recipients. Mendy has been the Labs’ laser safety officer and a laser program subject matter expert since 2008. Her program improvement efforts include laser safety training. Sandia has three other certified laser safety officers at the New Mexico and California sites. — **Luke Frank**

**Photo courtesy of Mendy Brown**



**SUNNY DAY** — Laurie Burnham, project lead for a new international consortium that will share data to help expand markets for solar photovoltaics, shows an array of pyranometers at the meteorological station of Sandia's Photovoltaic Systems Evaluation Laboratory. The instruments measure solar irradiance, the primary variable in PV system performance. Consortium members will collaborate on a study of pyranometer variability to quantify the uncertainty of irradiance measurements worldwide. **Photo by Randy Montoya**

## Global collaboration to study photovoltaic performance, reliability

By **Kelly Sullivan**

**A**n international community of research institutions, led by Sandia, to advance photovoltaic research and expand solar markets formally launched its work on May 14 in Munich, Germany, with a memorandum of understanding.

Called the Photo-Voltaic Collaborative to Advance Multiclimatic Performance and Energy Research, or PV CAMPER, the organization provides a unique platform for studying photovoltaic performance and reliability in multiple, diverse environments and climates, said project lead Laurie Burnham.

“What we’ve created is a network of research-grade field sites around the world that allows members to share data with confidence,” Laurie said. “But PV CAMPER also works because of its collegiality. There’s a trust and camaraderie to the work we’re doing, each learning and building off the other, challenging best practices and collaborating with organizations that share the same values.”

Laurie said the idea for PV CAMPER came out of a meeting in South Korea two years ago, where she presented information about

the Regional Test Center program. The RTC, managed by Sandia for DOE, supports studies of emerging solar technologies at multiple U.S. field sites. An impromptu discussion about replicating the RTC concept globally led to the idea for the collaborative, and the core group has expanded from five to 11, with more members likely.

PV CAMPER organizations have the common goal of a more solar-intensive future, Laurie said. The umbrella organization will offer:

- A repository of high-fidelity meteorological and PV performance data from geographically and climatically diverse sites.
- Broad expertise in areas of PV research such as soiling losses, the uncertainty drivers impacting solar-energy yields, such as cloud persistence, moisture and airborne particulates, and spectral responsiveness.
- Data to support the design and optimization of PV systems for specific operating environments to increase markets and expand the solar industry.

Member organizations will transmit data daily to a cloud database for access by the collaborative. They also will adopt PV CAMPER

baseline characterization and operation and management protocols and participate in collaborative research and development.

PV CAMPER signatory organizations include Sandia; Universidad Federal de Santa Catarina in Brazil; Anhalt University of Applied Sciences, and Fraunhofer Center for Silicon Photovoltaics in Germany; Institut de Recherche en Energie Solaire et Energies Nouvelles in Morocco; Qatar Environment and Energy Research Institute in Qatar; Solar Energy Research Institute of Singapore; and Yeungnam University, Korean Institute for Energy Research and Korea Testing Laboratory in South Korea. Other institutions are lining up to join, Laurie said.

DOE has funded Sandia’s leadership of PV CAMPER for one year, to help get the collaborative off the ground, Laurie said, while the other 10 signatories self-fund their participation and may assume leadership roles in the future.

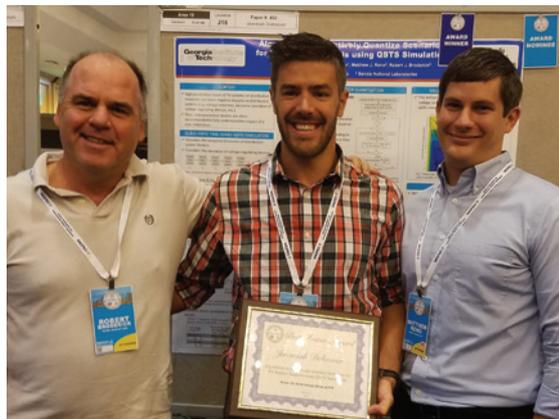
“What matters is that the consortium is seen as a high-value endeavor by a growing number of institutions and serves as a catalyst for collaboration in the global transition to a low-carbon economy,” she said. [t](#)

## Rooftop solar panels

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“The project tackled four main areas to make time series analysis faster — with the idea that each of the four areas was developed independently — and then they were combined,” Matthew said. “For example, if each method makes the analysis 10 times faster, when we combine two methods, it could be 100 times faster.”

An analysis now runs 1,000 times faster than two years ago, Matthew said. The software can take a simulation that used to take 36 hours and complete it in less than five minutes on a standard desktop computer.



**SPREADING SOLAR SOFTWARE** — Presenting their collaborative research to develop quantization methods that speed up quasi-static time series analysis at a meeting of the Institute of Electrical and Electronics Engineers are (from left) Sandia engineer Robert Broderick, Jeremiah Deboever from Georgia Tech and Sandia’s Matthew Reno.

Photo courtesy of Matthew Reno

The team first considered how to reduce how often the electric grid power flow had to be simulated over time. Instead of simulating each second of the year individually, the software moves through the simulated year at a varied pace, taking into account whether it’s night or day or likely to be cloudy or sunny at that time of year.

“You can jump through time faster at some points and put the computational effort where it is most needed, using event-based simulation or variable time-step,” Matthew said. “During cloudy periods with varying amounts of sunlight, the simulation slows down and looks at the impact second by second. When there is low variability, like at night when everything is fairly stable, the simulation can jump forward with larger time steps, making the program more efficient.”

The second part of the project focused on making the individual simulations faster by updating the formulas used to calculate the power flow. The team worked with the developers of the most commonly used commercial and open-source electric distribution system software to improve input and output, memory management and algorithms for large datasets.

The third challenge focused on reducing the complexity of the power-grid model the software uses while maintaining its accuracy. The smaller, more efficient model helps the software solve problems faster by focusing its analysis on critical parts of the grid.

The fourth part of the project focused on changing how a standard business computer runs the analysis to ensure all the processing cores are used. “In quasi-static time series analysis, each second is

dependent on the one that came before, which means everything had to be done sequentially, on a single processor, on a single core,” Matthew said. “Your desktop computer could have seven other cores sitting there doing nothing while a single core performed the simulation for the entire year by itself.”

The new software separates parts of the year or parts of the grid, assigns them to each of the available computing cores and runs them in parallel.

While the focus of the project has been on supporting rooftop solar, Matthew said the new software also can evaluate new technology and smart grid controls.

“As we look to the future with new smart grid applications and controls, utility companies are going to have continued need to use time-series analysis to see how new electric car charging will impact neighborhoods, investigate the best energy storage controls and applications or determine how smart home controls, like thermostats and lights, can benefit their grids,” Matthew said. “In order to understand the new benefits and controllability of the smart grid, these companies will have to be able to simulate it first.”

The team has published more than 30 papers, and the improvements are being shared with utilities, universities and other researchers in several ways. CYME International is adding components of the code directly into its commercial software, and improved timeseries analysis tools have been included into the newest versions of EPRI’s OpenDSS Distribution System Simulator and in Sandia’s GridPV MATLAB Toolbox. [t](#)

# Sandia celebrates Pride Month

By **Katrina Wagner**

The Sandia Pride Alliance Network teamed with other organizations at the Labs to celebrate Pride Month this June and held a series of conversations that centered on intersectionality.

SPAN chair Chris LaFleur said, “The Pride Blitz this month was a series of fantastic events where we engaged with several other employee groups and shared the ways we are different, as well as highlighted our commonalities.”

Hispanic Outreach for Leadership and Awareness and SPAN discussed how Hispanic and LGBTQ cultures intersect and collide in the community. Diversity Cinema featured “Love, No Matter What,” a film about accepting your children unconditionally.

Sandia employees and their families and friends gathered June 8 to watch the Albuquerque Pride Parade along Central Avenue. “The Sandia Pride parade-watching event this year was fun and attracted more than 60 attendees, which is the biggest turnout at Pride we’ve had so far,” said Sandian Audrey Morris-Eckart. “We had a lot of fun wearing lab coats to represent Sandia’s STEM focus and enjoyed the shaded watching area.

“Next year, we plan to have both a parade-watching event and a group marching in the parade, with expectations to even further increase participation from our expanding membership,” Audrey said. [f](#)



Top photo by Mary Watson and bottom photos by Katrina Wagner



## Wind blade reliability

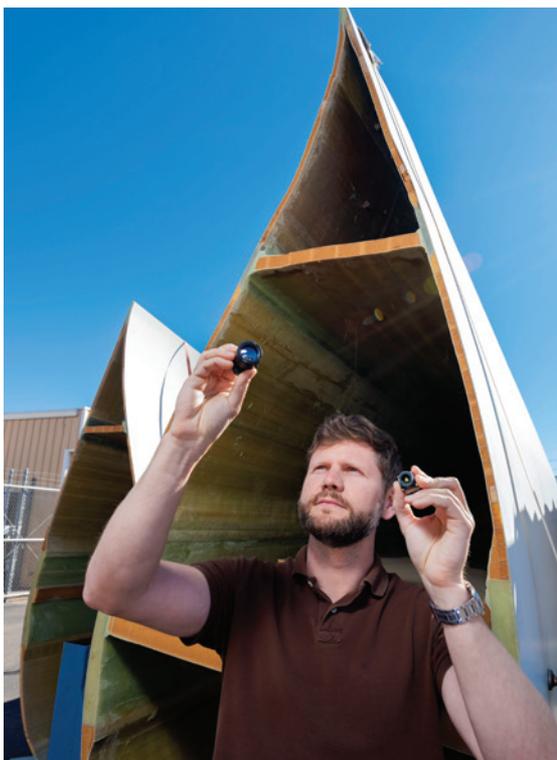
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and down a wind blade, like someone mowing a lawn. On-board cameras provide real-time, high-fidelity images to detect surface damage, as well as small demarcations that may signal larger, subsurface damage. While moving, the robot also uses a wand to scan the blade for damage using phased array ultrasonic imaging.

The scanner works much like the ultrasound machines used by doctors to see inside bodies, except in this case it detects internal damage to blades by sending back a series of signals. Changes in these ultrasonic signatures can be automatically analyzed to indicate damage.

Sandia senior scientist and robotic crawler project lead Dennis Roach said that a phased array ultrasonic inspection can detect damage at any layer inside the thick, composite blades.

“Impact or overstress from turbulence can create subsurface damage that is not visually evident,”



**READY FOR A CLOSE-UP** — Mechanical engineer Ray Ely inspects the cameras to be tested on drones that use thermography to detect hidden wind blade damage.

Photo by Randy Montoya

he said. “The idea is to try to find damage before it grows to critical size and allow for less expensive repairs that decrease blade downtime. We also want to avoid any failures or the need to remove a blade.”

Dennis envisions the robotic crawlers as part of a one-stop inspection and repair solution for wind blades.

“Picture a repair team on a platform going up a wind blade with the robot crawling ahead,” he said. “When the robot finds something, remotely located inspectors can have the robot mark the spot so that the location of subsurface damage is evident. The repair team will grind away the damage and repair the composite material. This one-stop shopping of inspection and repair allows the blade to be put back into service quickly.”

### Drones use heat from sunlight to reveal blade damage

Sandia worked with several small businesses in a series of projects to outfit drones with infrared cameras that use the heat from sunlight to detect hidden wind blade damage. This method, called thermography, can detect damage up to a half inch deep inside the blade.

“We developed a method to heat the blade in the sun, and then pitch it into the shade,” Sandia mechanical engineer Ray Ely said. “The sunlight diffuses down into the blade and equalizes. As that heat diffuses, you expect the surface of the blade to cool. But flaws tend to disrupt the heat flow, leaving the surface above hot. The infrared camera will then read those hot spots to detect damage.”

Ground-based thermography systems are currently used for other industries, such as aircraft maintenance. Because the cameras are mounted on drones for this application, concessions have to be made, Ray said.

“You don’t want something expensive on a drone that could crash, and you don’t want a power hog,” he said. “So, we use really small infrared cameras that fit our criteria and use optical images and lidar to provide additional information.”

Lidar, which is like radar but with light instead of radio frequency waves, measures how long it takes light to travel back to a point to determine the distance between objects. Taking inspiration from NASA’s Mars lander program, the researchers used a lidar sensor and took advantage of drone movement to gather super-resolution images.

“I jokingly describe super-resolution as like a detective on a TV crime drama when they tell a tech to ‘enhance, enhance’ an image on a computer,” Ray said.

A drone inspecting a wind blade moves while it takes images, and that movement makes it possible to gather a super-resolution image.

“You use the movement to fill in additional pixels,” he said. “If you have a 100 by 100-pixel camera or lidar and take one picture, that resolution is all you’ll have. But if you move around while taking pictures, by a sub-pixel amount, you can fill in those gaps and create a finer mesh. The data from several frames can be pieced together for a super-resolution image.”

Using lidar and super-resolution imaging also makes it possible to precisely track where the damage on a blade is, and lidar can also be used to measure erosion on blade edges.

### Autonomous inspections are the future

Autonomous inspections of bridges and power lines are already realities, and Joshua believes they also will become important parts of ensuring wind blade reliability.

“Autonomous inspection is going to be a huge area, and it really makes sense in the wind industry, given the size and location of the blades,” Joshua said. “Instead of a person needing to walk or drive from blade to blade to look for damage, imagine if the inspection process was automated.”

Joshua said there is room for a variety of solutions and inspection methods, from a simple ground-based camera inspection, to drones and crawlers, all working together to determine the health of a blade.

“I can envision each wind plant having a drone or a fleet of drones that take off every day, fly around the wind turbines, do all of their inspections, and then come back and upload their data,” Joshua said. “Then the wind plant operator will come in and look through the data, which will already have been read by artificial intelligence that looks for differences in the blades from previous inspections and notes potential issues. The operator will then deploy a robotic crawler on the blade with suspected damage to get a more detailed look and plan repairs. It would be a significant advance for the industry.” [f](#)

## Celebration honors Deputy Labs Director Dave Douglass



Deputy Labs Director Dave Douglass

Photos by **Lonnie Anderson**

A June 13 celebration honored Deputy Labs Director Dave Douglass, as he departs Sandia at the end of June. Attendees gathered to thank Dave for his service and commitment to Sandia National Laboratories and his dedication to national security.

Under Dave's leadership and guidance, Sandia has seen significant improvement in numerous areas, including the Laboratory Policy System, the Labs' approach to environmental safety and health, the Financial Simplification Model, project and program management and implementation of the Laboratory Operating System.

"It's been my privilege to work with Dave Douglass for over three years," Labs Director Steve Younger said. "His experience as a leader has brought a perspective that has added immeasurably to Sandia's senior leadership team. Dave can be a quiet person, but his ideas have permeated everything that NTESS has done at the Laboratories."

Steve credited Dave with crafting the five initiatives intended to retool Labs operations. "We

needed a simpler financial system, and Dave oversaw the creation of the financial system that saved the Labs tens of millions of dollars. We needed a simpler and more efficient policy system, and Dave oversaw the creation of a new system that is more than three times faster than the old one. We needed a better way to assess performance, both of the overall organization and also individual employees, and Dave oversaw the implementation of improvements in both of those things," Steve said. "None of these things have been simple.

"It's one thing to have a vision of what you would like to do. It's another thing to make it happen. Rarely does a single individual have both of those qualities," Steve said. "Dave Douglass is one of those rare individuals."

On behalf of NNSA Administrator Lisa Gordon-Hagerty, NNSA Sandia Field Office Deputy Manager Mike Duvall presented Dave with the NNSA Administrator's Distinguished Service Gold Medal. "My highest honor has been working closely with Dave over the last two plus years," Duvall said. "Dave's attitude of

collaboration, teamwork and openness directly contributed to improving Sandia National Laboratories."

"Dave's combination of expertise, experience and demeanor is exactly what was needed for a deputy director with responsibility for a contract transition of DOE's largest laboratory," Duvall said. "Dave's impact on national security throughout his career is impressive, but I'm glad I had a front-row seat to the leadership he provided this Lab over the last two years."

Following the award, Dave addressed the Labs. "Thank you for letting me be part of you for a few years," Dave said. "I'll tell you when I started, I thought I knew the Labs — I had no idea what you do. I thought I understood the impact you have — I had no idea the impact you have.

"The things this organization does and the many ways it touches this country, in ways this country will never know, is an incredible thing," Dave said. "I leave you wishing you all the very best because what you do is so important. Please keep that in mind."

Executive Chief of Staff Paul Cox concluded the ceremony. "You've laid a solid foundation for us to stand on as Sandia looks to the future," he said. "I speak for all of us when I say we wish you well in the next phase of your life and thank you for your exceptional service in the national interest." 



NNSA Sandia Field Office Deputy Manager Mike Duvall presents Deputy Labs Director Dave Douglass with the NNSA Administrator's Distinguished Service Gold Medal.

## Kyle Fuerschbach earns 2019 Kevin P. Thompson Optical Design Innovator Award



Photo by **Lonnie Anderson**

Sandia engineer Kyle Fuerschbach has been named the 2019 Kevin P. Thompson Optical Design Innovator Award recipient by the Optical Society. The award recognizes significant early-career contributions to lens design, optical engineering or metrology.

Kyle was recognized for his groundbreaking work in developing freeform optical surfaces that can be used to create lighter, more compact and more effective optical devices than are currently available.

While conducting graduate research in 2011, Kyle performed a computer simulation that placed a common surface deformation on a computer model of the James Webb Space Telescope. During the simulation, he noted a behavioral aberration that he traced to the nodal aberration theory developed by Kevin Thompson in 1979. Kyle's historic observation solved an analytic puzzle that had been worked on by leaders in the field for more than 100 years.

Kyle expanded the NAT theory for freeform optics in his PhD work, co-inventing, devising, manufacturing components for, assembling and aligning an optical system to conclusively validate his discovery and designing, specifying, testing and assembling the first imaging optical system using the expanded theory.

Applications for Kyle's design methods are numerous. They include 3D imaging and visualization, augmented and virtual reality, infrared and military optical systems, automotive and LED lighting, energy research, remote sensing, semiconductor manufacturing and inspection, and medical and assistive technologies.

"Kyle Fuerschbach, at an early stage of his career, has had a remarkable influence on the design and fabrication of complex optical systems," said 2019 OSA President Ursula Gibson. "His innovative approach and achievements are truly worthy of the Thompson Optical Design Award."

At Sandia, Kyle researches the design, fabrication and assembly of complex optical systems. His focus is on realization of optical payloads for remote sensing applications, with an emphasis on developing novel systems that are compact and manufacturable.

Kyle received his doctorate in optics from the University of Rochester in 2014, and his bachelor's degree in optical sciences and engineering from the University of Arizona in 2008. 



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**PRESENTS**

# OPERATION BACKPACK



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FOR DETAILS

# You can prevent wildland fires

By **Lyndsy Ortiz and Juan Molinar**

It's that time of year again when the potential for wildland fires is at its peak.

New Mexico's dry climate and spring winds play a large role in drying natural vegetation. Many wildland fires start from lightning strikes, and arson is also a leading cause.

Carelessness can also lead to wildfires, but a number of preventive measures can be taken to help mitigate the threat. Below are some helpful tips to consider:

- Use caution when participating in heat or spark-producing activities. Have a water source or a fire extinguisher readily available.
- Make sure your cigarettes are out before discarding. Don't flick cigarettes or throw them on the ground.
- Clear or maintain vegetation near your home, vehicles and other property.
- Establish fire breaks and barriers in areas of dense vegetation.
- When camping, be sure to thoroughly extinguish any fires and inspect your camp area before leaving.
- When hauling equipment, ensure all chains and other objects are properly fastened to

your vehicle to avoid dragging objects and generating sparks while driving.

- Be especially cautious during fire-danger weather.
- If you see something, say something.

## What should you do if you see a wildland fire onsite or offsite?

If you see an uncontrolled wildland fire onsite in New Mexico, call 911 from a landline or 505-844-0911 from a mobile phone. Offsite, call 911.

## What resources are available at Sandia and Kirtland Air Force Base?

Sandia has a Wildland Fire Management Plan that proactively seeks to prevent and mitigate the occurrence of a wildland fire through preventive maintenance measures. As you plan outdoor work activities, consider consulting with fire protection experts from Sandia Building and Fire Safety. The Sandia Emergency Management team is also a great resource and is always prepared to respond to any emergency.

Along with Emergency Management, the Kirtland Fire Department is available for incident response and is equipped with the necessary wildland firefighting equipment and training. If fires exceed their capabilities, additional resources will be dispatched from local agencies. 



Photos courtesy of Getty Images

## SANDIA CLASSIFIED ADS

**Note: The Classified Ad deadline for the July 5 issue of the Lab News will be Thursday, June 27, at noon instead of Friday, June 28. This deadline applies to the July 5 issue only.**

### AD SUBMISSION GUIDELINES

**AD SUBMISSION DEADLINE:** Friday noon before the week of publication unless changed by holiday.

Questions to Michelle Fleming at 505-844-4902.

Submit by one of the following methods:

- **EMAIL:** Michelle Fleming (classads@sandia.gov)
- **FAX:** 505-844-0645
- **MAIL:** MS1468 (Dept. 3651)

- **INTERNAL WEB:** Click on the News Tab at the top of the Techweb homepage. At the top of the NewsCenter page, click the "Submit a Classified Ad" button and complete the form.

Due to space constraints, ads will be printed on a first-come, first-served basis.

### MISCELLANEOUS

DAY BED W/TRUNDLE, w/ both mattresses, trundle raises up to day bed height, for 2 twin beds, text for photos. Keller, 505-917-7591.

KHATA CEREMONIAL SHAWL, from Tibet, w/ symbols woven in white into fabric, brand new, \$5. Wagner, 505-504-8783.

UPRIGHT DIGITAL PIANO, Technics PX662, 88 keys, bench, \$1,000. Lukens, 505-286-6482.

BAR TABLE, modern glass tabletop, w/4 black & white leather square stools, \$350. Johns, 505-280-4072.

DRESSER, antique Tiger oak, medium wood tone, curved front, restored, excellent condition, \$250. Diaz, 505-821-0868.

DRAFTING MACHINE, Vemco Precision, model 2100-24, w/scales, used once, paid \$514, make reasonable offer. Baca, 505-792-1941.

CURIO CABINET, antique, early 1900, curved glass, excellent condition, \$1,000, negotiable, photos available. Sichler, 505-565-5885 or 505-227-3141.

COFFEE TABLE, cherry, Amish Connection, \$400; square end table, \$300; oval end table, \$250; all 3 hand-made, Queen Anne-style legs; queen sofa sleeper, \$500; La-Z-Boy furniture. Pacheco, 505-948-9407.

'10 JOHN DEERE X300R, riding mower tractor, 340 hrs., w/wagon, grass collector, cover, rear collect kit, works, \$2,200. O'Grady, 720-587-9857.

WEAVING LOOM, 4 harness jack loom, 6 pedal, 800 heddles; recently re-built/refinished, \$550. Bonadore, 505-280-7781.

VACUUM PUMP, SW1397, Hastings gauges, pump oil, electric motors, solar hot-air collectors. Baca, 505-615-7316.

PIANO, Baldwin Howard, walnut finish, great condition, \$600. Trainor, 505-328-7069.

LIONEL TRAINS & ACCESSORIES, 1950s vintage, all very good-excellent condition, email for itemized list & prices. Eckelmeyer, keckelmeyer@comcast.net.

FITBIT VERSA, 2, black, only had them 6 mos., photos available, paid \$200 ea., asking \$100 ea. Pacheco, 505-816-8501.

CRICUT AIR EXPLORE 2, rose gold, new-in-box, retails \$227, asking \$150; Instapot Duo Plus, 8-qt., used once, retails \$160, asking \$100. Lusk, jlusk5885@gmail.com.

TWIN AMPLIFIER, Fender, 65 circuitry, custom 15-in. speaker, excellent condition, \$900. Stubblefield, 505-263-3468.

COUCH SET, 4-pc., good condition, \$400; entertainment center, oak, 3-pc., \$200; TV stand, \$50; PowerWheel car, \$75. Graham, 505-293-7302.

### TRANSPORTATION

'01 VOLKSWAGEN JETTA GLS, 1.8T, 5-spd. manual, 28+ mpg., AC, sunroof, leather, heated seats & mirrors, \$2,000 OBO. Brothers, 505-369-9899.

'06 GX470 LEXUS, 4x4, SUV, 2nd owner, maintenance records, 132K miles, great condition, must see, \$950 <book, \$10,500. Mirabal, 505-270-0074.

'96 TOYOTA TACOMA SR5, 3.4L, 5-spd. manual, 4x4, 165K miles, no mechanical issues, \$7,800. Cervantes, ulises85@gmail.com.

'07 HONDA CIVIC LX, 2-dr. coupe, silver, original owner, 129K miles, \$2,900. Prasad, 505-850-8237.

'06 WRB SUBARU STI, 111K miles, good condition, \$19,500 OBO. Flores, 505-715-0430.

### RECREATION

MOUNTAIN BIKES, East Mountains: men's trail bike Mongoose MGX 6.5; women's MOTIV M Smoothie; have not used in years, \$100 ea. Willmas, djwillmas@gmail.com.

'06 KAWASAKI EN500C VULCAN, garage kept, regular maintenance performed, great for commuting, \$2,400 OBO. Salzbrenner, 505-980-1451.

'05 DUCATI MULTISTRADA MTS1000DS, red, factory hard bags, 14K miles, \$2,500 OBO. Strasburg, 505-459-2891.

ROAD BIKE, KHS CX1000, cantilever brakes, rear suspension, Shimano, photos available, \$250. Hanks, 505-243-1931, call or text.

BICYCLE, Raleigh Gran Sport, 27-in., blue, well maintained, never damaged, w/every maintenance tool, many accessories, \$75. Woods, 505-720-8492.

'12 DUCATI 1199, 6,640 miles, well maintained, excellent condition, inquire for modifications. Luu, 808-989-2644.

RAPTOR TOY HAULER, 41-ft., 2 restrooms, 2 refrigerators, 2 power queen beds, in garage, + loft, full body paint, \$32,000. Cuoco, playhardroy@gmail.com.

'17 RETRO TRAILER, 18-ft., customized for better livability, only 3,500-lbs., excellent condition, listed \$24,000 new, asking \$16,500. Langwell, 505-350-1313.

### REAL ESTATE

VACANT LAND, Moriarity Heights, 3 adjoining lots, ~7.5 acres, paved road, except last 3/4 mile, \$8,000 per lot. Victor, 505-220-1010.

5-BDR. HOME, 3 baths, 3-car garage, build in 1995, <https://tinyurl.com/y5gky5n3>. Yohannes, 505-348-9495.

4-BDR. HOME, 2-car garage, 2,508-sq. ft., tiled pitched roof, fireplace, central heat, refrigerated air, granite, 98th & Ladera NW, \$259,000 terms. Sanchez, 505-515-5997.

3-BDR. HOME, 2-1/2 baths, Willow Wood, near Eubank gate, new heat/cooling, nice, MLS#943303, call to take a look, FSBO, \$275,000. Dinge, 505-818-8933.

LAND, in Rancho Verde, Tijeras, lot 77, MLS#943854, price just dropped, \$29,900. Ramos, 972-951-0290.

3-BDR. CUSTOM HOME, 2 baths, modern, 1 story, 2,510-sq. ft., ~3 acres, East Mountains, Tijeras, \$380,000. Jones, 505-235-5110.

LOT FOR SALE, 8.6 acres, Escobosa/East Mountains area, \$29,000 OBO. Moreno, 505-238-0494.

### WANTED

QUILTER/SEAMSTRESS, turn Little League jerseys into 2 separate quilts, contact w/cost estimate. Muhlberger, 362-8731, ask for Linda.

SOUND BOARD, for Hopi Junior/Senior High School, 4 channels or more, donations are tax deductible. Strip, 505-328-7490.

### WORK WANTED

HOUSE/PET/BABY SITTING, for Albuquerque area, Academy grad, references available. Stegmaier, 505-331-7676, ask for Rachael.

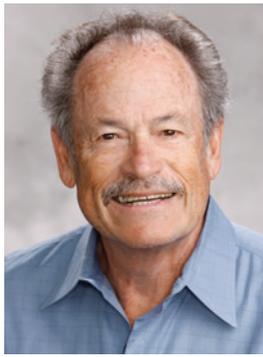
### AD RULES

1. Limit 18 words, including last name and home phone (web or email address counts as two or three words, depending on length).
2. Include organization and full name with 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. The same ad may not run 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 and retired Sandians only.
10. Housing listed for sale is available without regard to race, creed, color or national origin.
11. Work wanted ads are limited to student-aged children of employees.
12. We reserve the right not to publish any ad that may be considered offensive or in poor taste.

# Mileposts



*New Mexico photos by Michelle Fleming  
California photos by Randy Wong*



Don Cowgill 45



Robert Allen 40



Lubomyra Kmetyk 40



Jack Wise 40



Jeff Alexander 35



John Garcia 35



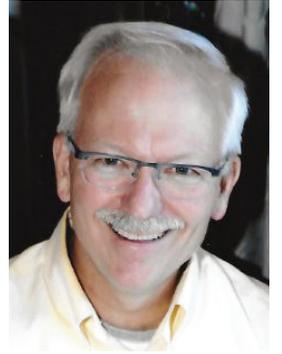
Philip Kahle 35



Clinton Landron 35



Joseph Maestas 35



Perry Molley 35



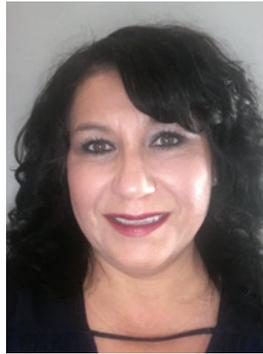
Richard Rodarte 35



Daniel Summers 35



Clara Chacon 30



Joy Giron 30



John Linebarger 30



Kimball Merewether 30



Ed O'Toole 30



Katherine Simonson 30



Paul Sanchez 25



Steve Beresh 20



Hugh Bivens 20



Eileen Rios 20



Anita Schreiber 20



Adam Tanuz 20



Janson Wu 20



Mandy Younger 20



Andrew Aboytes 15



Fabian Aragon 15

# Recent Retirees



*New Mexico photos by Michelle Fleming  
California photos by Randy Wong*



Michael Widmer 38



Eunice Young 38



Walt Heimer 36



Shannon Letourneau 33



Bill Peters 32



Walter Wapman 32



Vanessa Miles 30



Chris Wilson 20



David Heredia 19



Kevin Kelsey 16

Retiring and not seen in the Lab News pictures: Kevin Marbach, 34 years.



**FUTURE STEM LEADERS** — Some of the teenagers participate on robotics teams, but for others, this camp was an opportunity to explore something new. Multiple participants said they hope to pursue STEM fields in the future.

## Students compete for best 3D-printed design during Sandia robotics camp

By **Manette Newbold Fisher**  
Photos by **Randy Montoya**

On a sunny Friday morning at the Robotics Vehicle Range, 14 local students were in competition mode, huddled around 3D printers they built, and laptops running 3D modeling software programs. They were divided into teams the day before and challenged to print original 3D designs before 3 p.m. that day.

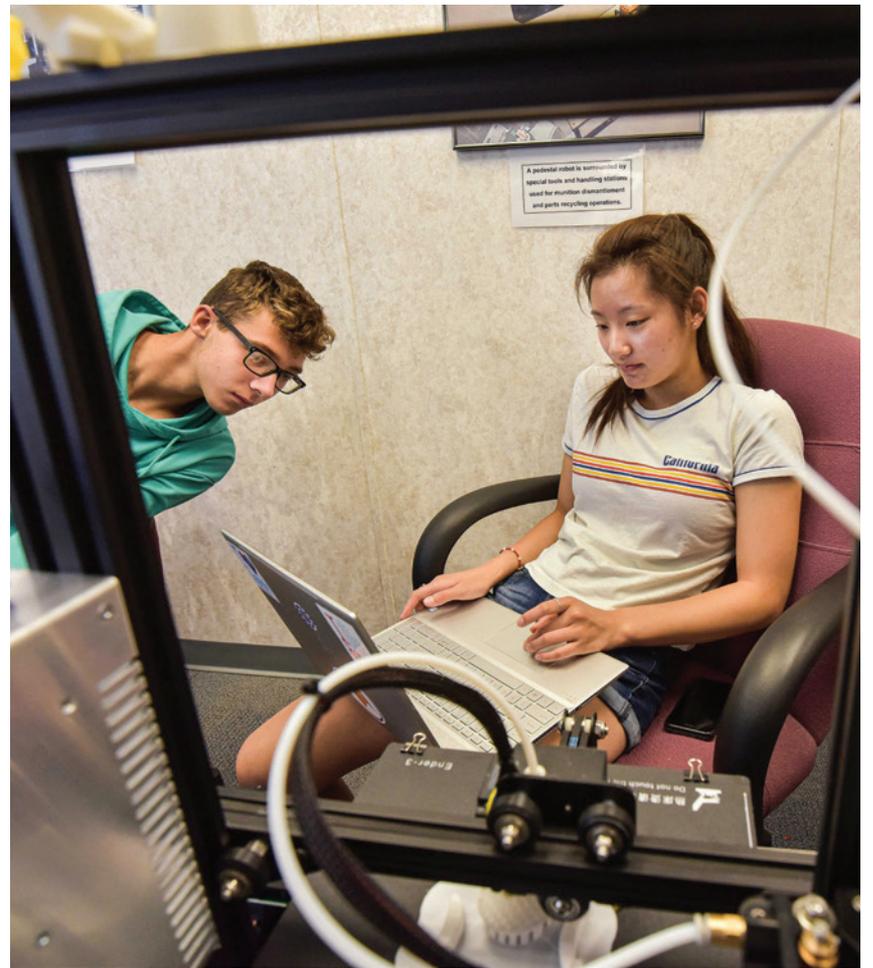
The competition was part of a second annual week-long robotics camp from May 27-31, hosted by Sandia in collaboration with R4 Creating, a nonprofit organization that provides robotics and STEM opportunities for kids.

Sandia graduate student intern John Krukar taught camp participants how to build the 3D printers at the beginning of the week. He provided 3D model files they could use right away to print Nintendo characters Bulbasaur and Mario, steamboats and lizards, then he helped them design original figurines using free open-source programs. John also used a 3D depth camera to capture the teenagers so they could print action figures of themselves.

Shelly Gruenig of R4 Creating said one goal of the camp was to help kids figure out what they want to be when they grow up. Throughout the week, Sandia employees who work in a variety of positions spoke to the group about their careers. Gruenig said she also wants to give kids opportunities to try new things and work with others.

The winning team designed and printed WALL-E and Eve figurines based on the Disney Pixar movie. For some of the kids, it was their first time working with the design programs, and the camp gave all participants a chance to collaborate and make connections with other students. Some students said they hope to continue studying STEM fields and possibly work at the Labs someday.

“If half of these kids ended up being future Sandians, how awesome is that, right?” Gruenig said. “They heard some amazing stories from people throughout the week of how they started as an intern, how they thought they were going to be an artist, and the next thing they know they’re working on photons.” [@](#)



**TECH TEAMING** — Robotics camp students worked together in 3D modeling programs to design original 3D prints.



**ORIGINAL ACTION FIGURES** — Camp instructor John Krukar (not pictured) used a 3D depth camera to capture the participants so they could print figures of themselves.



**BUILD, DESIGN, PRINT** — Sandia worked with nonprofit organization R4 Creating to host a week-long robotics camp for local teenagers. Kids were taught how to build 3D printers, create original designs and print multiple objects on their own and in teams.