SANDIA LABNEWS
PUBLISHED SINCE 1949

Vol. 75, No. 14, July 27, 2023

DOE small-business awards Page 6

What do you do with a shrunken laser?

EXPERIMENTAL WAFER — More than a thousand experimental lasers and amplifiers adorn a three-inch, gold-electroplated silicon wafer made at Sandia's Microsystems Engineering, Science and Applications complex. **Photo by Craig Fritz**

Sandia invents method to integrate microscale optical devices on silicon microchips

By **Troy Rummler**

The laser is so small you need a microscope to see it properly. But it's not just the size that scientists at Sandia are excited about.

The buzz is that the laser can now be combined with other microscale optical devices to make self-driving cars safer, data centers more efficient, biochemical sensors more portable, and radars and other defense technologies more versatile.

Sandia has been awarded a patent for its new method of integrating many

— CONTINUED ON PAGE 3

More holistic, efficient tests for protective equipment

Molding devices to humans

By **Kim Vallez Quintana**

A team at Sandia has developed a faster and more comprehensive way of testing personal protective equipment. The basic principle: modeling a device to fit the human form and human behavior.

When COVID-19 hit, PPE testing became an urgent need. In March 2020, when the country went into lockdown, many people turned to Sandia for PPE testing support. They were trying to bring new masks to the market, provide quality assurance for imported masks and vet cleaning processes for reuse of single-use PPE.

"Whether using in-house or commercial filter test systems, we found the testing process was very time-consuming and not as efficient as it could be," Sandia aerosol scientist Michael Omana said.

The team, which includes engineers Todd Barrick and Brad Salzbrenner, was determined to find a better solution.

"We were trying to think of ways that respirators could be tested rapidly, not destructively, and have other testing capabilities introduced, including going beyond testing material filtration," Todd said.

— CONTINUED ON PAGE 4

SEEING THE HUMAN SIDE — Aerosol scientist Michael Omana and his team created a new way to test PPE using a more human form. **Photo by Craig Fritz**

SANDIA LAB NEWS
PUBLISHED SINCE 1949
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 Thursdays by Internal, Digital and Executive Communications, MS 1468

LAB NEWS ONLINE: sandia.gov/LabNews

TABLE of CONTENTS

EDITOR'S NOTE: Please send your comments and suggestions for stories or for improving the paper. If you have a column (500-800 words) or an idea to submit, contact Lab News editor Katherine Beherec at kgbeher@sandia.gov.

DATA DIGGER — Sandia helped the Cybersecurity and Infrastructure Security Agency develop a new toolset to quickly analyze and isolate unusual data in cloud computing environments. **Getty Images**

Sandia helps develop digital tool to track cloud hackers

By **Michael Ellis Langley**

Sandia programmers are helping the federal Cybersecurity and Infrastructure Security Agency through an innovative program that enlists Microsoft cloud users everywhere to track down hackers and cyberterrorists.

Untitled Goose Tool was introduced to the public through a CISA alert in March. Sandia cybersecurity expert Wellington Lee was part of the team that developed the free tool to track potentially malicious activity in Microsoft Azure, Azure Active Directory and Microsoft Office 365 environments.

"All these environments are very, very different so we wanted to figure out what is the best way to very quickly get all the cloud information that we need to be able to do what we do from a forensic standpoint," Wellington said. "Cybersecurity in general is a fast, evolving field. But cloud computing, especially, is much newer in comparison to your traditional computer or network forensics

where people are looking at a thing on-site. It is a new area to try and figure out what is the best way that we can do this."

Untitled Goose Tool is a **suite of data collection tools** that can quickly scour a virtual storage space to find evidence of a possibly malicious user accessing the data, gather data on how they accessed the supposedly secure cloud space and bring the data back to CISA's security experts for review.

"Sometimes it's a large department or agency with tens of thousands of users," Wellington explained. "So that's a lot of data that we have to work with. The tool is able to pull down data for all those users, which is not a simple feat."

But it could also be small businesses with payroll and other information stored virtually. In short, Untitled Goose Tool can be very helpful for a wide variety of accounts of differing sizes to find bits of code left behind by an intruder. But that variety, which also includes different types of paid access, also makes things complicated — which programmers had to account for.

"That's why we built the Untitled Goose Tool, to be able to pull that data back, so we have all the data locally and we can do analysis on that data without relying on capabilities in the customer's cloud environment," Wellington said.

The idea for this forensic software came organically while Wellington was deployed to support CISA. The team working on cloud computing forensics — which serves federal, state, local, tribal and territorial agencies — were getting called in to investigate data breaches in systems that differ as much as the groups that use them and had a short amount of time to try to figure out what happened.

"These environments are not homogeneous," he added. "Large departments or agencies with tens of thousands of users, maybe even up to 100,000 plus users, is a lot of data that we have to work through. We created Untitled Goose Tool to be agnostic to the customer's subscription tier of their cloud environment."

Gathering as much data as possible no matter what customer environment they are in became very important, so the team and Wellington started with the Microsoft servers.

"We figured out what is the best way to get all the cloud information that we need to do what we do from a forensic standpoint, and do so really quickly," he recalled, adding that cyberthreats are constantly evolving.

"In the cloud, you might have someone impersonating someone else," he said. "Perhaps they got an authentication token stolen through a phishing e-mail. So, let's say someone's authentication token might have been stolen and then used to log in as Michael Langley from Los Angeles. But we can see that Michael Langley is not in Los Angeles. This looks suspicious, so Untitled Goose Tool pulls back data that can help identify some of those inconsistencies. It pulls back quite a lot of different types of logs from various sources in the cloud."

The appointment of Sandia to aid CISA speaks to the expertise that the Labs brings to these kinds of threats.

"We have a unique level of expertise in terms of our cybersecurity," Wellington said. "We have a smaller presence in terms of how many physical people are working with CISA, but we bring a really advanced level of understanding of the nation's problems. From deep in the weeds, all the way up to sweeping policy that affects a lot of things."

It's a relationship that continues to evolve and pay dividends for the nation. Something Wellington has seen first-hand.

"It's really cool to see how much excitement there is around the tool," he said. "But the war goes on. There are always improvements that we have the expertise to make that give our federal partners valuable tools to continue to protect the nation."

Shrunken laser

CONTINUED FROM PAGE 1

different materials onto silicon — the same starting material semiconductor fabrication plants use to make microchips.

This method enables Sandia to build high-bandwidth, high-speed optical devices, including indium phosphide lasers, lithium niobate modulators, germanium detectors and low-loss acousto-optic isolators — all critical components for high-power optical systems.

Building a laser on silicon is a challenging and unusual feat that could extend America's leadership in semiconductor technology. Other organizations, including the University of California, Santa Barbara, and Intel Corp., have built similar lasers, but Sandia has broadened the class of devices that can be integrated. For the first time, these devices could work together on optical microchips, also called photonic integrated circuits.

"This allows the U.S. to lead and have less dependency on foreign manufacturing capabilities," Sandia's Patrick Chu said.

CHARACTERIZING LASERS — Sandia scientist Ashok Kodigala aligns a fiber to a chip-scale, heterogeneously integrated laser under a microscope at the MESA complex. **Photo by Craig Fritz**

Patrick co-leads the National Security Photonics Center, a group of more than 60 photonics scientists and engineers at Sandia's Microsystems Engineering, Science and Applications complex.

Integration with silicon a key step toward future production

Silicon is the lifeblood of the semiconductor industry and a great material for making computer chips. However, by itself, it's a lousy material for making lasers, said Sandia research scientist Ashok Kodigala, a co-inventor of the new integration process.

His challenge was to design a way for optical components made from a variety of materials to coexist on a silicon microchip.

These kinds of materials can't just be glued into place, so instead Ashok fused them to silicon in complex layers, a process also called heterogeneous integration.

The Sandia team successfully demonstrated heterogenous integration techniques to create hybrid silicon devices: hybrid lasers and amplifiers made from both indium phosphide and silicon, and similarly modulators made of both lithium-niobate and silicon, which encode information in light generated from the lasers.

Moreover, high-power and high-speed germanium detectors were developed to keep up with the lasers and modulators under the same platform.

While Ashok and his team are motivated by the progress they've made, they say they need to further refine their methods with industry partners before photonic chips can start rolling off the production lines.

In future research, Ashok is hoping to combine lasers with the other optical components onto a single chip.

Semiconductor fabs could use Sandia technique

Sandia built its chip-scale lasers with a goal of transferring the technology to industry. The team used many of the same tools found at commercial semiconductor plants, and the lasers generate light in wavelengths commonly used in the telecommunications industry, called the C-band and the O-band.

"Once we demonstrate this photonic platform at a national lab, we can then pass this technology to U.S. companies, where they can focus on even larger-scale production for commercial and U.S. government applications," Ashok said.

He conceived his method with funding from Sandia's Laboratory Directed Research and Development program and developed it under a Defense Advanced Research Projects Agency program called Lasers for Universal Microscale Optical Systems.

Photonic semiconductors support CHIPS and Science Act

President Biden made headlines in 2022 when he signed the CHIPS and Science Act, a nonpartisan, $52.7 billion boost for the semiconductor industry. While the legislation is expected to increase production of American-made computer chips, it also directs funding for photonic semiconductors.

Sandia is also investing in optical microchips because they transmit more information than conventional ones. But manufacturing challenges have prevented their widespread adoption, Patrick said. Even though the technology is well known in scientific circles, on most microchips, he said, electronic technologies still reign supreme.

With a working platform to build photonic circuits, Sandia has positioned itself to support industry and other institutions performing photonics research and development in the coming years. Sandia research is not currently funded by the CHIPS Act.

"We know our process is scalable, so that's one way we're supporting the CHIPS Act mission," Patrick said. "Sandia is eager to collaborate with others and start building new technologies together."

Researchers interested in partnering with Sandia to develop silicon photonic technologies are invited to contact **photonics@sandia.gov** to learn about emerging opportunities.

PPE

CONTINUED FROM PAGE 1

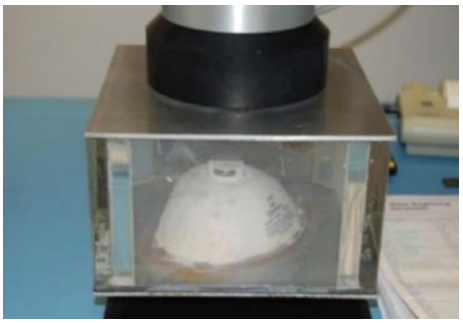
All the while, the pandemic was worsening. Recognizing how high the stakes were, the team quickly got to work and grew from a team of a few to a team of many. With each new person came added skills and perspective. They included electrical engineers, mechanical engineers, aerosol scientists, biologists, additive manufacturers and others. "It really allowed Sandia to introduce a lot of the expertise within the labs and to employ a lot of those capabilities," Michael said.

The current way of testing

The current method for testing PPE involves attaching a mask to a flat plate inside a box using hot wax or putty, then introducing a test aerosol to measure penetration levels. To achieve certification from the National Institute for Occupational Safety, 20 masks of the same type must be tested. That has proven to be time-consuming. During the pandemic, it resulted in a massive backlog for the respirator industry.

However, the team said time was just one issue. The current process doesn't account for other factors in mask use.

"All you are doing is testing the filter media itself," Todd said. "It doesn't test geometry, how the respirator fits on a face, how it's moved on and off multiple times, how the straps perform, how the nose bridge performs, how the mask can wear over time."



THE OLD SCHOOL WAY — N95 current testing method requires a mask to be attached to a flat surface using melted wax or putty.
Photo courtesy of the National Institute for Occupational Safety and Health

There was also the issue of PPE reuse.

With such a worldwide shortage, frontline workers were forced to reuse respirators designed for single use. However, there was no standard method of testing mask reuse.

"I think there were a lot of lessons learned with everyone suddenly looking at what the industry standards were," Michael said.

A new idea

The team had a new idea to speed up the process and make it more effective.

Step one: Get rid of the archaic wax melt and turn to science.

Step two: Test the mask in more realistic conditions.

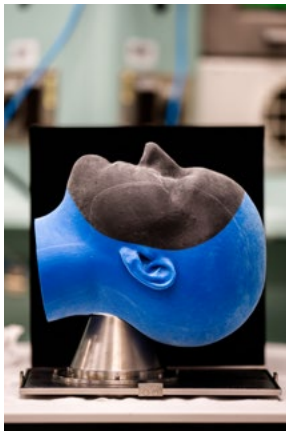
DRAWING ON THE HUMAN FORM — One of the first versions created by the team to test performance of a mask on a human face.
Photo courtesy of Michael Omana

The team started by creating a model of a human face that could be loaded into a commercial filter test system.

"We wanted quicker testing and to look at more features, like how does the mask fit on a face," Brad said. "We used 3D printing capabilities to make it more pliable, like skin."

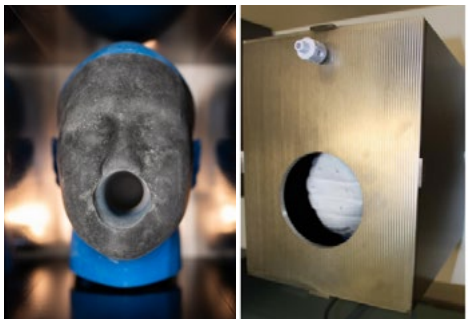
Once the mask is affixed to the form, the tester applies pressure to give an airtight seal and then introduces the aerosol.

But the team agreed even more could be done. The current testing standards don't account for how a real person might wear a mask and the gaps or flaws that a mask might present in real-life conditions. So, they developed a more complex version using a complete human head.



PERFECTING THE HUMAN FORM — Gen 2 integrates a more human-like form for testing.
Photo by Craig Fritz

Once the mask is affixed, the entire head is put in an airtight box that is then placed in the machine and tested, allowing for a more natural flow of air over the mask and what they believe is a more realistic picture of mask performance.



MOVING TO THE NEXT STEP — Gen 2 test fixture integrates a more human like form that is integrated with commercial filter testers.
Left photo by Craig Fritz; Right photo courtesy of Michael Omana

The mechanical engineers on the team then took things one step further to help address PPE reuse, something there is currently no testing standard for.

"We developed the chamber version to automate donning and doffing (putting on and taking off an item) to test respirator function over time, a predominant factor in wear on a mask. It also mimics how a mask is set on the face and shows you any gaps that air and particles can get past," Brad said. The team says this can be used in addition to the other testing models they created or developed to be an all-in-one tester. All of which would be a big advance in the way PPE is tested in the U.S. as well as other countries.

"I call it holistic testing," Michael explained. "It takes into account all of the aspects of the mask. Aerosols are like electricity and take the path of least resistance. Even if the filter media is doing great, if another subcomponent is failing, the PPE can be rendered useless. Current testing standards do not quantitatively test PPE in a real-use capacity. This emulates the real-world use of PPE."

What's next?

The team is now working to further test their approach with the help of $100,000 in funding from Sandia's Technology Maturation Program. The goal is to license out the science to a company that can produce it on a commercial level, which is part of Sandia's tech transfer initiative.

TURNING TO MECHANICS — Click to watch the team's mechanical test fixture. This model supports reuse testing, including donning cycles, speed and mask displacement.
Animation by Craig Fritz

Rising to the challenge

At a time when countless lives were at stake, and like so many times before, when the world had a problem, Sandians tackled it.

"Without the diverse capability of people at Sandia, a project like this would not have happened. If you look at the background of each of the people on this team, everyone comes from a different discipline or walk of life. It was a combination of all these people who made these things happen," Brad said.

"As a national lab we are fortunate to have some of the brightest minds. With that expertise, we felt it was our responsibility to do something to help the community," Todd added.

The team says one of the best parts of this project is that it happened organically. "Everyone just jumped in to help. When we needed an answer, someone would say, 'I know who can answer that.' We would contact that someone and they would get involved. The amazing thing about this is that people donated their time," Todd said. "People worked more than was asked of them, to help solve this problem. It really was out of the goodness of their hearts. This was a call to action."

DOE awards Labs for helping small businesses

By **Kim Vallez Quintana**

For the second consecutive year, Sandia's Mentor-Protégé Program has been named Mentor of the Year by the DOE Office of Small and Disadvantaged Business Utilization.

The DOE Awards Program has also named Sandia's Supply Chain Subcontract Manager Sofia Delgadillo-Marrufo as Facility Management Contracting Officer of the Year, and Santa Fe-based Sandia subcontractor Wildflower International Ltd. was awarded HUBZone Small Business of the Year.

The annual DOE awards recognize small-business advocates for their efforts to help small businesses grow and share their technical solutions in support of national security and energy missions.

Mentor-Protégé Program

Sandia's Mentor-Protégé Program, led by Royina Lopez, is now in its fourth year and is currently mentoring five small businesses:

- Pluma LLC, a general construction business in Albuquerque, New Mexico.
- Strategic Industry Inc., a construction business in Kingsburg, California.
- CeLeen LLC, an information technology business in Perryville, Missouri.
- Dynamic Structures and Materials LLC, a precision motion systems manufacturer in Franklin, Tennessee.
- Compunetics Inc., a circuit board manufacturer in Monroeville, Pennsylvania.

Through its 127 mentors, the program provides specialized training and support that helps these businesses develop and grow, secure DOE prime contracts and subcontracts and foster long-term relationships that help Sandia achieve its mission. One way they do that is by providing innovative and reliable products necessary for the work that happens at Sandia.

Three of the five protégés are considered disadvantaged by the Small Business Administration. Pluma and Strategic Industry are owned by disabled veterans, and CeLeen is tribally owned.

Protégés say the help that Sandia has provided has proven priceless. "Learning the Sandia way and the different processes have been an eye-opener. We have taken the feedback and knowledge from Sandia and applied it to our safety plans and quality plans, which has helped the overall business. We are also seeing significant growth as a small business," said representatives of Strategic Industry in the program's nomination submission.

MENTOR OF THE YEAR — Sandia Mentor Protégé Program Lead Royina Lopez, center, accepts the award for DOE Mentor of the Year at a ceremony on July 11. Ron Pierce, Director of DOE Office of Small and Disadvantaged Business Utilization, left, and small-business owner Wendell Pierce presented the award. **Photo by Patricia Brown**

Facility Management Contracting Officer of the Year

Sofia, who was awarded Facility Management Contracting Officer of the Year, has been working for Sandia for nearly 20 years. She works closely with CeLeen in the Mentor-Protégé Program.

Through their partnership, Sofia helped identify areas of need at Sandia that could be met by CeLeen. She has helped the business learn and understand the procurement process, gain experience and grow their capabilities. The partnership has resulted in the awarding of two information technology contract purchase agreements to CeLeen, with a potential total value of $8 million.

The company currently provides software development, information technology project management and cloud-based support systems to help Sandia achieve its mission. Since it became a protégé, CeLeen has added six employees, which is significant growth for a business of its size.

"I was really happy to receive the recognition. I really enjoy what I do every day and working with CeLeen has been a growth opportunity for both of us," Sofia said. "It has been a wonderful relationship that I look forward to continuing. I want to see how they succeed, not only at Sandia but across the entire DOE complex."

HUBZone Small Business of the Year

Wildflower International, recognized as HUBZone Small Business of the Year, is a small information technology business based in Santa Fe that provides support to Sandia, Los Alamos and Lawrence Livermore national laboratories. Wildflower International was founded by Kimberly deCastro in 1991 in her daughter's bedroom. The business has been working with the DOE community ever since. The three national labs joined together to nominate Wildflower, stating that its understanding and handling of supply chain constraints helped Sandia and Los Alamos carry out their missions in a critical time.

The company provides, among other things, the ability for the labs to search for supplies within their own procurement system and deliver them in days instead of weeks, reducing the wait and cost. The company can provide 24-hour turnaround delivery for urgent needs. In fiscal year 2022, Wildflower filled 1,165 orders that included 61,166 items. It also helped negotiate special pricing from suppliers resulting in the savings of more than $3.2 million.

"Our customers are our mission, so the fact that we are being recognized for helping them complete their mission means that we've done a pretty good job at ours. It's humbling and makes us all very proud," said Justin Thigpen, DOE business unit director at Wildflower International.

"DOE is at the cornerstone of Wildflower's history. It was the company's first customer and remains its most important," deCastro added. "DOE is both a customer and a mentor, with a commitment to mutual success. We are proud to serve our customer and our community. After all, shouldn't it always be that way?"

Wildflower has transformed that way of thinking into an annual scholarship. Created in 2022, the Dell Technologies/Wildflower International Endowed Scholarship Fund provides financial support to high school students in northern New Mexico pursuing studies in computer science and other technologies. The inaugural recipient is Los Alamos homeschool student Samuel Landis, who has since secured an internship at Los Alamos National Laboratory.

SMALL BUSINESS SUPPORTING LABS — The Wildflower International team, including Operations Manager Cheri Chandler, second from left, DOE Business Unit Director Justin Thigpen, center, and DOE Operations Senior Manager Marlena Lucero, second from right, accepts the HUBZone Small Business of the Year award. The award recognizes Wildflower's critical support of Sandia, Los Alamos and Lawrence Livermore national laboratories. **Photo by Patricia Brown**

SMALL-BUSINESS ADVOCATE — Sandia Supply Chain Subcontract Manager Sofia Delgadillo-Marrufo, center, receives the Facility Management Contracting Officer of the Year award for her successful partnership with small business CeLeen through the Mentor-Protégé Program. **Photo by Patricia Brown**

Sandia makes changes for competitive job market

Multipronged strategy helps attract top talent

By **Kenny Vigil**

Sandia has enhanced its recruitment and hiring strategy to help fill mid-to-senior experienced career positions, as well as entry-level jobs.

Focusing on recent undergraduates, the Labs has supersized its Critical Skills Recruiting Program; targeting more experienced talent, Sandia's Talent Acquisition Recruiting has added a new role to its arsenal; and to further bolster its efforts, Sandia has increased the number of staffing partners.

Young, diverse talent is critical

In June, the Critical Skills Recruiting Program started welcoming new employees, increasing its hires to almost 30 this fiscal year, up from eight the previous year.

The program recruits people who recently completed a bachelor's in a skill Sandia deems critical, with a focus on building a diverse, qualified candidate pool. About 70% of this year's candidates exhibited that diversity. More than 40% of the hires are women engineers.

The employees are spending the summer at Sandia, learning their roles and connecting with their teams, before starting graduate school in the fall.

"The Critical Skills Recruiting Program is our opportunity to grow and develop future researchers for the Labs that align with our mission needs," said Ana Garcia, who leads hiring for the program. "We're investing in them by providing a fully funded master's degree, and after completing the program, they return to the Labs as full-time R&D staff."

NEW COLLEAGUES — Lindsey Lubin, center, introduces herself to Dana Figueroa during the June 7 orientation for Sandia's Critical Skills Recruiting Program. Participants Lindsey and Dana will attend Georgia Tech and New Mexico Tech, respectively, this fall to pursue graduate degrees. **Photo by Craig Fritz**

WARM WELCOME — Madison Lund talks to her manager, Rob Kress, during the June 7 orientation for the Critical Skills Recruiting Program. Madison will attend the University of New Mexico in the fall and work on her graduate degree in mechanical engineering. **Photo by Craig Fritz**

Ana partners closely with University Programs, which administers the Critical Skills Recruiting Program.

The group hired this year must pursue a master's degree in electrical engineering, mechanical engineering, computer engineering or computer science to qualify for coverage of tuition and tuition-related fees. The area of study can change based on mission needs. About 73% of those selected for the program were current or prior interns.

Finding experienced talent

Sandia is also making changes to engage with hard-to-fill, critical experienced talent, which includes the addition of the technical recruiter role within Talent Acquisition Recruiting. The shift refocused existing employees and added eight new technical recruiters over the past year, bringing the total technical recruiter roster to 10. There's now at least one technical recruiter supporting each division at Sandia.

"For some positions, there might only be 30 qualified people nationwide to fill that highly specialized technical job. We look for candidates who haven't applied and, in some cases, who haven't even heard of Sandia," said technical recruiter Dwight Beck, describing the search process for what recruiters dub passive talent, or employed people who are not looking for a job.

After talking to the hiring manager about specific qualifications and the ideal candidate to fill a hard-to-fill niche position, the technical recruiters start researching, sourcing candidates and building the talent pool.

"We're only called in for the difficult-to-fill positions," technical

recruiter Meg Duba said. "I think that referring to it as needle-in-a-haystack recruiting is a little too easy."

Advanced search methodologies are used to locate prospective candidates, such as Boolean search criteria on various job boards, OpenWeb search, cold calling and leveraging various social media platforms. "The candidates we want are also wanted by a lot of other national labs and high-tech competitors. We must really sell our mission and its importance," Meg said.

Recently, a position that was open for about two years was filled in just several weeks by the technical recruiting team. "The technical recruiter was able to meet with the hiring manager and then find the right passive candidate," Dwight said.

Consultative approach

As part of its talent acquisition strategy, Sandia has also increased the number of staffing partners to work with hiring managers. The change helps reduce the number of job requisitions per staffing partner, allowing for a more strategic and consultative hiring approach.

"Our focus is on creating a more holistic approach to hiring," said Wade Bodlovic, senior manager of talent acquisition. "Our staffing partners work closely with hiring managers from start to finish in the hiring process, easing the burden on the manager."

With fewer job requisitions per staffing partner, the change is designed to allow staffing partners to be proactive versus reactive in the hiring process, leading to more strategic engagement with the objective of reducing hiring time.

"We've implemented a robust recruiting and staffing strategy that focuses on early-to-late career talent, which will help ensure Sandia has the right people at the right time to meet our critical mission needs," Wade said.

Attracting early career employees

Sandia is enhancing its recruitment strategy to attract early career employees. Some changes include:

- Increasing the number of universities for recruitment based on critical needs.
- Shifting college and university recruitment focus to Labswide jobs instead of specific positions.
- Improving the student intern experience with year-round events, such as the summer welcome event, career week, Student Symposium and the Senior Manager Shuffle, which helps interns get a glimpse into what their managers do while providing networking opportunities supporting intern conversion.

Ergonomics is the backbone of employee health

Making home offices ergonomically safe and healthy for the growing remote and hybrid workforce

By **Stephanie Hobby**

The COVID-19 pandemic created an employee health nightmare: In the blink of an eye, thousands of Sandians had to pack up their ergonomically designed, on-site spaces and set up makeshift offices at home. Sandia ergonomics engineer and engineering program lead Lance Perry had just been hired when he was called upon to do the unthinkable task of making thousands of home offices safe for work.

Even with 40 years of experience behind him, it was a daunting task.

"People were working in apartments, garages, and sometimes closets to preserve line-of-sight security," he said. "The entire family was home, not just one adult. Kitchen tables were consumed. It was chaotic. We tried our best to get some semblance of logical accommodations, but more importantly, help people to understand that they weren't alone, and that it would get better."

On the job site, ergonomics engineers can create ideal conditions. They can install the right type of desk, chair or desktop equipment and come to your office to assess your setup and make personalized recommendations. When the world went virtual, all of that changed.

From their own homes, Lance and the

THE RIGHT FIT — Subcontract manager Carolyn David scheduled a visit with the ergonomics team to properly fit her workspace at home. "The difference is huge. It all equates to good form and that impacts my health, longevity and productivity," she said. **Photo by Craig Fritz**

ergonomics team created training videos and presentations to address how to best make the transition to a home office. They developed a library of seven videos that had not existed before. One of the fundamentals was optimum seating posture. Then, through a combination of reviewing photos and talking over the phone, the team could provide Labs' staff with a variety of suggestions.

There were limits, however. New desks weren't an option, but eventually, staff were able have their office chairs delivered to their homes, leading to a dramatic improvement.

"The chair is 75% of the problem or solution, so if you get the right chair under everybody, you'll be a long way there. The other 25% is more behavioral than anything. That was our approach to get some control on total chaos," Lance said. "We didn't have a built-in mechanism to deliver it to everyone … but we're there now."

By mid-2021, office setups had stabilized, and Lance and the ergonomics team realized the 80/20 scenario, whereby 80% of the workforce didn't need as much support, and the remaining 20% was manageable.

Within three years, they had impressively performed over 6,000 personalized evaluations.

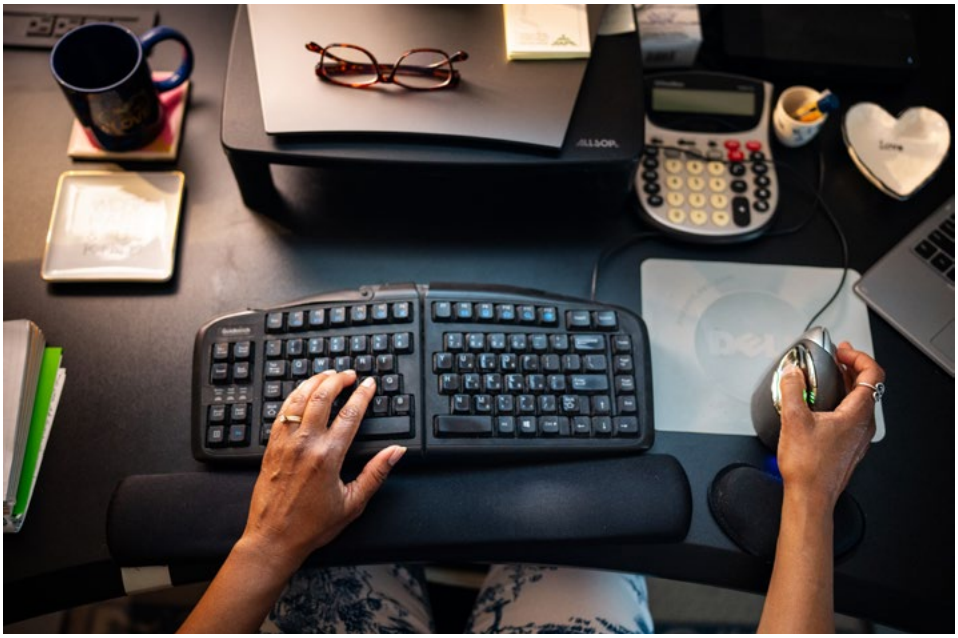
Today, with over 4,000 members of the workforce in a telecommuting or remote agreement, Lance and the ergonomics team are still working to ensure that every space is designed to be ergonomic, whether at home, a touchdown space or an on-site office.

"Right now, we have reservable touchdown spaces, and we have made them fundamentally ergonomically correct for a typical person. We're still working on houses; not every house is the way we want it, but our philosophy is the same: It doesn't matter if you're working at home or Starbucks or the office or conference room. Can we get you in properly fitted, correct support angles? If we can achieve that, we can't do anything more as ergonomists."

Lance emphasizes that members of the workforce need to be in the right angulation with the right support. Optimizing the correct angles reduces the biostatic pressures, and relieves all the joints in a body, reducing the risk of musculoskeletal disorders.

"An injury will not allow you to do well at anything. The reality is that it's a performance science and affects people mentally, physically and physiologically. We try to prevent fatigue and injuries, errors, omissions, cognitive issues, because those can be as costly as anything," Lance said.

"At the end of the day, the success of every company is dependent on the success of the individual; if you help people with what they do, it helps the bottom line."



IDEAL SETUP — Subcontract manager Carolyn David worked closely with the ergonomics team to ensure that the positioning of her keyboard, mouse, wrist pads, desk and monitor are ergonomically correct. **Photo by Craig Fritz**

Tips for working from home

According to Sandia ergonomics engineer and engineering program lead Lance Perry, here are five things to consider when working at your house.

Work at a designated computer station. Couches, beanbags and upside-down paint buckets will not offer the same support as an ergonomically designed desk and chair.

Avoid working solely on a laptop. Lance said this is the most egregious mistake anyone can make. The laptop is designed for short periods of time, such as on a construction site or taking notes in a classroom. It was never designed to be a permanent, eight-hour-day platform. The hinge causes the monitor and keyboard to be adjacent to each other, which puts strain on the neck. "When you work all day with your neck bent over, you become a prime suspect for musculoskeletal disorders," Lance said.

Avoid sitting for long stints. Humans developed to accommodate physical activity, and everyone needs to get up and move around regularly.

Use the right chair. The chair is the single device at your desk that you interface with the most. Hands do not interface with the keyboard as much as your body interfaces with a chair.

Maintain a neutral posture. This principle was originally derived from NASA research, and the benefits of a neutral posture are increased comfort and reduced chance of injury.

If you have questions or would like to schedule an evaluation, visit the ErgoZone website at **ergozone.sandia.gov**.

Mileposts


Sabine Boruff 35


Mark Howard 35


JD Patrick 35


Eric Thulin 35


Rich Detry 30


David Moore 30


Brian Mileshosky 25


Emily Wright 25


Nathanael Brown 20

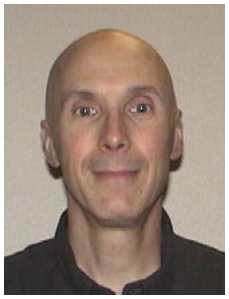

Ben Huff 20


Jon Wegener 20


Dean Dominguez 15


Donavon Gerty 15


Laura Matzen 15


John Nogan 15


Tyler Smith 15

Recent Retirees


David Heckart 30

QCaMP inspires quantum-ready workforce

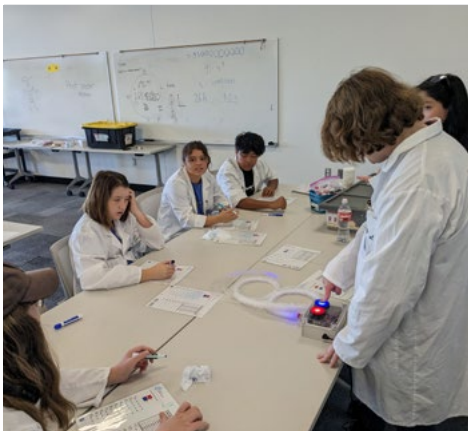
By **Debra Menke**

Sandia partnered with Computer Science Alliance, Lawrence Berkeley National Lab, Los Alamos National Lab and other sponsors to conduct two QCaMPs, weeklong camps that engage both teachers and students in quantum physics concepts.

QCaMP provides attendees with a comprehensive introduction to computing fundamentals, hands-on exploration of quantum physics and practical applications of these phenomena to solve computing challenges.

This immersive virtual and in-person camp hosted 15 teachers from New Mexico and 42 students from New Mexico and California, teaching quantum physics concepts to inspire future careers. By engaging teachers and students as leaders in discovery, innovation, national security and research and development competitiveness, QCaMP plays an important role in building a quantum-ready workforce.

To learn more about how to get involved in QCaMP next summer, reach out to QCaMP@sandia.gov.



SECRET MESSAGES — Students learn how to encode messages in binary and send those encoded messages with light using fiber optics.
Photo by Ray Tokuta, Albuquerque Public Schools

QUANTUM PHYSICS, NEAR AND FAR — Physicist Megan Ivory, bottom right, wraps up QCaMP with in-person and virtual students.
Photo by Ray Tokuta

ENLIGHTENED EXPERIENCE — Students engage with Sparking Curiosity in Quantum Science students as they explore light polarization.
Photo by Ray Tokuta

Battling an existential threat

Sandia manager Lynn Yang leads in the fight for climate security

By **Sarah Jewel Johnson**

Working to address climate change is nothing new to Sandia's Lynn Yang. She began researching climate change mitigation in graduate school and has since had a successful research career spanning biodefense, cybersecurity and critical infrastructure resilience.

Lynn is the manager of Sandia's Systems Research and Analysis group in the Sandia California Computation and Analysis for National Security Center. The group provides national leaders with reliable, unbiased and comprehensive information on viable engineering and strategy options, and on the effectiveness, risks, benefits and potential unintended consequences of those options.

Lynn applies systems perspectives to climate challenges, pulling from her experience in risk analysis and homeland security. She helped develop the Labswide climate security strategy and remains an active leader in Sandia's climate work, which applies a defense-in-depth approach that layers research and development in four dimensions: awareness, mitigation, adaptation and intervention.

Lynn received a bachelor's degree in civil and environmental engineering and a master's degree in technology and public policy, both from the Massachusetts Institute of Technology.

Lab News interviewed Lynn to learn more about her perspective on climate research, her layered defense approach and a "teach the teacher" theory of recruiting others to join the efforts against climate change.

Lab News: Why are you passionate about climate change?

Lynn Yang: Climate change is an existential threat. It affects all of us globally and so it's something that we should all care about and work on, especially those of us working in national security.

I started working on climate change in graduate school, 1995 to 1997, in a technology and public policy program at MIT. This program was focused on the role of policy to inform research and development and technology development to help address global problems and improve our way of life. Back then, I researched mid-sized, coal-fired industrial boilers which produce heat for industrial processes in China's rural areas, given their large contribution to global greenhouse gas emissions. My research found that one major cause of heavy emissions had nothing to do with a technology need, but rather efficiencies. Many of these boilers were in poor repair. Straightforward measures such as maintenance to patch cracks in the chimney, where heat was being released before it could be used, could make a big difference. The solution didn't necessarily require innovation, but instead required policy and process changes. Furthermore, boiler owners were incentivized to make these improvements because it would save cost and they could burn less coal to generate the required amount of heat.

CLIMATE SECURITY CHANGEMAKER — On the weekends, Lynn and her family spend time outside. Here, they're paddling their 18.5-foot yellow canoe they call Glide on the Big River in Mendocino County, California.
Photo courtesy of Lynn Yang

There are many actions we can take to make gains against climate change and sometimes it's as simple as maintaining systems already in place. We need to analyze risks and pursue all high-traction measures, from low-hanging fruit to major process, technology and policy efforts.

I started working on the issue of climate change early in my career, and then moved to a host of other national security areas like countering weapons of mass destruction, disaster management and cybersecurity. After becoming a manager, I heard about Rob Leland and Susan Altman's effort to develop a Labs' Climate Security Strategy and made a beeline to join that team. I'm happy to have the opportunity to work on this critical national and global security topic again.

LN: What does "climate security" mean to you?

LY: I view climate security as stability and resilience in the face of climate change. Climate change is affecting our environment, our infrastructure and our way of life, including fundamental needs and the things that make life comfortable, interesting and fun. Climate security is not just national security, it's security around our way of life.

LN: What climate-related challenge are you most excited to work on?

LY: I'm excited to develop and execute a holistic approach to climate security. We've defined climate security as a layered approach across four interconnected areas of activity: awareness, mitigation, adaptation and intervention. I'm working with a team of climate researchers, scientists and innovators to make research and development advances in all four areas.

At Sandia, by utilizing our research and engineering capabilities, and relying on our systems approach to complex problems,

we can make gains in all four of these areas: build awareness of climate change impacts, mitigate the highest emitters of greenhouse gases, characterize needed adaptations across the national security enterprise and critical infrastructure sectors and support governance of climate interventions. I'm excited to work with my colleagues on high-leverage, high-traction research and development to address climate change.

LN: How does your work at Sandia advance climate security?

LY: As a manager, I work through others. My job is to set priorities, create the environment and pull together people and capabilities to produce the highest impact climate security R&D. I'm fortunate to work with passionate teams who are advancing climate security in many important ways.

You may have heard of tipping points — it's this idea of runaway problems that, if not addressed, accelerate and cannot be reined in. Methane release in the Arctic region is a potential tipping point. There is enough methane — a powerful greenhouse gas — locked up in the Arctic permafrost to completely swamp a lot of our mitigation efforts. If methane is released, according to reasonable assumptions about Arctic warming, ensuing permafrost thaw and other environmental impacts like wildfires and ground collapse could occur. So, we need better data on the Arctic methane positive feedback cycle to inform earth systems models and critical decisions like carbon budgets and investments in research and development. Sandia has sensor technologies, facilities, modeling expertise and ongoing research in the Arctic that will produce critical data and understanding on this potential tipping point.

Our team is also looking at the impacts of climate change on our critical infrastructure to identify adaptations that are needed for resilience. Sandia has a long history in critical infrastructure modeling to analyze risks arising from natural hazards or human-made threats. We are applying those capabilities to the climate change threat, to inform adaptations to operations, systems and infrastructure.

LN: What unique perspective or capabilities does Sandia bring to addressing the climate crisis?

LY: Climate change is a multi-faceted, complex issue, and many solutions and innovations that are needed for climate security require a systems approach. As a national security systems engineering and research laboratory, Sandia has much to offer. We have a history and long-standing capabilities in relevant areas such as renewable energy, nuclear energy, earth systems modeling, sensing, Arctic and geosciences, resilient energy systems, carbon capture, critical infrastructure decision support and more.

LN: What does the nation or world look like in the future if we are successful in addressing climate change?

LY: The environmental impacts of our activities and systems are an externality — these impacts are not factored into the price of goods and services. We will naturally move, and move much faster, toward climate security if we factor environmental considerations into our economic cost-benefit calculations and if we align economic and environmental incentives. This ties back to my graduate research on Chinese industrial boilers, in which we uncovered efficiencies that bolstered both economic and environmental objectives. My vision for a climate-secure world is one in which climate change and environmental considerations are measured and incorporated into the economics that drive our choices, policies and systems.

LN: What's your vision for integrating energy equity and environmental justice into Sandia's climate security efforts?

LY: Sandia is investing in climate security innovations that improve the stability and resilience of our critical infrastructure and our communities. That said, our nation's existing critical infrastructure doesn't serve our communities equitably. Just as we need to address the externality problem for the environment, we also need to address the externality problem for equity and justice, factoring equity into the economics that drive investment, requirements and policy.

This fundamental problem faces a great deal of inertia, but in the meantime, Sandia can make progress by factoring equity and justice into our own calculations, such as our techno-economic analyses that assess and inform our climate security investments in innovation. Sandia should continue our ongoing work to provide underserved and underrepresented communities, such as tribal communities, with the understanding, data, resources and tools they need for climate security.

LN: If you were trying to recruit or inspire somebody to work on the problem of climate change what would you say to them?

LY: I would say, climate change is an urgent, existential problem that requires transformational innovation, as well as a holistic approach that spans science, engineering, policy, economics and more. Within the climate security space, you will find interesting and critically important problems to work on and a passionate community with diverse and multidisciplinary perspectives, as well as strong mission orientation.

LN: How can we educate and involve more people in addressing the climate crisis?

LY: Climate security starts with awareness. We are increasingly seeing climate change effects on our day-to-day lives, whether it's high temperatures, extreme weather events, failing infrastructure, water scarcity or other effects. I just gave a talk at Sandia's Kids Day, where the theme was climate change. I was very happy to learn that climate change is now a standard science curriculum topic as early as elementary school. If we widely propagate understanding of climate change risks, and ways to address climate change — from changes in our individual choices and actions, to devoting a career to climate security — the hope is that climate security will naturally fold into the actions, decisions and work of current and future generations.

In graduate school, in 1996, I started a program that taught high school students how to teach others about climate change. The concept was to "teach the teacher" so we could spread the word about climate change faster. We need to inspire others through awareness and science-based information.

Careerapalooza propels professional success at the Labs

By **Kerri Dufault**

Over three days in June, about 2,000 Sandians participated in career talks, résumé reviews, career mapping, games like Sandia Jeopardy, speed mentoring, mock interviews, panel discussions, student intern events and in-person career fairs to propel their professional journeys at the Labs.

"Careerapalooza is about helping Sandians see the possibilities that exist for them to grow their career, build their network and expand their skills without ever leaving the Labs," said Executive Director of Human Resources, Communications and Employee Health Services Brian Carter.

Careerapalooza culminated with three lively in-person events in California and New Mexico on June 29. In Albuquerque, the lobbies of two auditoriums were filled with interns and seasoned Sandians from every division. In Livermore, the General Access Area Event Pad hosted a steady stream of attendees participating in mock interviews, receiving resume feedback, having professional headshots taken and selling out a local food truck.

Attendees and event representatives alike shared their career stories and aspirations, sought and provided insight into division operations and had fun while learning about the exceptional career opportunities and development resources available at Sandia.

"Careerapalooza allowed me to get career advice directly from professionals who I hope to become one day," student intern Stephanie Nathasingh said. "It inspired me to pursue a full-time position at Sandia, and I'd love it if I could find a career here."

Representatives from Sandia's Career Development Office; employee recreation program; Employee Health Services; Inclusion, Diversity, Equal Employment Opportunity and Affirmative Action team; Organizational Culture and Engagement team; Workplace Improvement teams; and employee resource groups were also on-site to share information and ways for Sandians to get more involved.

"Careerapalooza is an awesome event," said manager for Environment, Safety and Health technical operations Cynthia Rivera. "I loved the informational presentations and mock interviews. My goal is always to learn something new about Sandia. Careerapalooza helps you understand how you can further your career vand build your network."

Careerapalooza first launched last summer as part of the Sandia Spark initiative, which aims to foster an environment where employees feel as energized, valued and engaged as they did on the first day.

SANDIANS SHARE THEIR CAREERAPALOOZA EXPERIENCES

CAREER STORIES — From left to right, moderator Carey Eichhorst and panelists Nando Betancur, Zach Mikelson, Jason Crenshaw and Matt Suazo discuss their careers at Sandia during a Careerapolooza event on June 27. **Photo by Craig Fritz**

MAKING CONNECTIONS — Intern Owen Schroeder, right, thanks Dan Roettgen from environmental testing during Careerapalooza on June 29.
Photo by Craig Fritz

RESUME REVIEW — Environment, Safety and Health coordinator Gary Wright, right, reviews a resume and offers suggestions to postdoc Wendy Angelica Garcia during Careerapalooza. **Photo by Craig Fritz**

NETWORKING FOR SUCCESS — Sandians in Livermore, California, attend an in-person event at the General Access Area Event Pad to participate in mock interviews, have headshots taken and more.
Photo by Tahmina Azimi