SANDIA LABNEWS
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The doer behind HBCU partnerships **Page 12**

Hey! Where's my qubit?

LOSS DETECTION — Matthew Chow, center, and Bethany Little discuss with Yuan-Yu Jau, off camera, the first practical way to detect atom loss for neutral-atom quantum computing at Sandia. **Photo by Craig Fritz**

Vanishing atoms can ruin quantum calculations. Scientists have a new plan to locate leaks.

By **Troy Rummler**

Quiet quitting isn't just for burned out employees. Atoms carrying information inside quantum computers, known as qubits, sometimes vanish silently from their posts. This problematic phenomenon, called atom loss, corrupts data and spoils calculations.

But Sandia and the University of New Mexico have for the first time demonstrated

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Sandia nabs two R&D 100 awards in 2024

Captured CO2 and enlarged alloys triumph

By **Neal Singer**

Researchers at Sandia have secured two prestigious R&D 100 Awards for 2024, distinguishing themselves among competitors from 16 countries, including the U.S., China and others from Europe and Asia.

The awards recognize the 100 most outstanding advances in applied technologies. R&D World Magazine, which presents the annual awards, focuses on practical impact over pure research, evaluating entrants based on their products' design, development, testing and production.

The awards highlight "demonstrable technological significance compared with competing products and technologies," for example, smaller size, faster speed or greater efficiency or environmental impact. Once dubbed "the Oscars of invention," the R&D 100 Awards continue to be a coveted recognition.

Since their inception in 1963, the R&D 100 Awards have recognized Sandia innovations 152 times, including this year's honors. One of the winning projects, led by researcher Tuan Ho, aims to reduce the airborne carbon dioxide that is increasingly warming the atmosphere. The other project, led by researcher Sal Rodriguez, seeks to produce industrially useful sizes of extremely strong heat-resistant materials.

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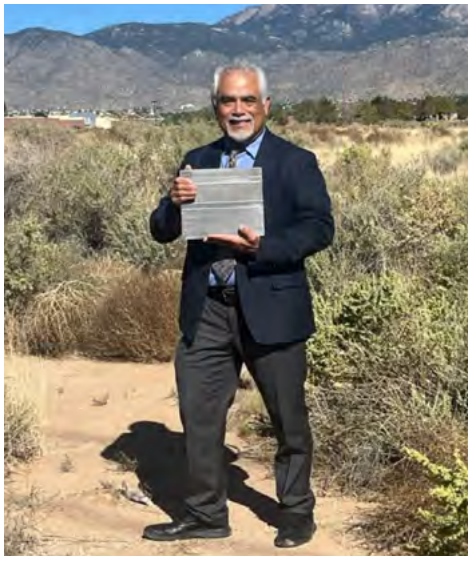

STRONGER ALLOY — Sal Rodriguez holds a refractory high-entropy alloy that broke the world record for length and mass.

Photo courtesy of Sal Rodriguez

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Sandia National Laboratories

Albuquerque, New Mexico 87185-1468
Livermore, California 94550-0969
Tonopah, Nevada | Kauai, Hawaii
Amarillo, Texas | Carlsbad, New Mexico | Washington, D.C.

Katherine Beherec, Editor kgbeher@sandia.gov
Ray Johnson, Production rbjohns@sandia.gov
Craig Fritz, Photographer cvfritz@sandia.gov
Michael Langley, California Contact mlangle@sandia.gov

CONTRIBUTORS

Michelle Fleming (milepost photos, 505-844-4902), **Neal Singer** (505-846-7078), **Kristen Meub** (505-845-7215), **Troy Rummler** (505-284-1056), **Meagan Brace** (505-844-0499), **Mollie Rappe** (505-288-6123), **Skyler Swezy** (505-850-2063), **Kim Vallez Quintana** (505-264-1886), **Kenneth Vigil** (505-537-1528), **Luke Frank** (505-844-2020), **Michael Baker** (505-284-1085) **Maggie Krajewski** (mkrajew@sandia.gov), **Valerie Alba** (vnalba@sandia.gov), **Lea Blevins** (lsblevi@sandia.gov)

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Researcher awarded 2024 Materials Research Society Medal

Hongyou Fan's use of pressure brings forth new materials and accolades

By **Neal Singer**

Sandia researcher Hongyou Fan has been awarded the prestigious 2024 Materials Research Society's MRS Medal, recognizing his innovative approach to synthesizing nanomaterials using pressure instead of traditional chemical solutions. The MRS Medal is the society's highest accolade, celebrating significant advances expected to greatly impact progress in materials science.

Hongyou's work is described as "pioneering pressure-induced nanomaterial synthesis and characterization for materials exploration and discovery."

"Using pressure has enabled us to form novel nanomaterial configurations with chemical and physical properties that weren't achievable through conventional methods, resulting in three patents," he said. "Depending on the applied pressure and starting materials, we have successfully fabricated a variety of metal, semiconductor and magnetic nanostructures and organic polymers with unique architectures and properties."

MATERIAL MASTER — Sandia researcher Hongyou Fan, recipient of the Materials Research Society's MRS Medal. **Photo by Jennifer Plante**

A key aspect of Hongyou's research involved using Sandia's pulsed power facility to scale up the intensity of the synthesis process. This allowed his team to study material behavior under dynamic conditions. It led to the development of a high-throughput fabrication process using dynamic electromagnetic forces at ultra-short nanosecond timescales — a first in the field, he said.

"Our fundamental work focused on utilizing diamond anvil cells to address scientific questions, demonstrate the fabrication of new materials, and explore novel structures and properties. This approach, while highly effective for fundamental studies, was limited to small sample sizes."

Using pulsed power provided significantly greater energy. "It enabled the fabrication of much larger samples and achieved the necessary pressures within nanoseconds — a dramatic improvement over current imprinting or embossing fabrication methods, which operate on time scales of seconds to minutes.

"This work underscores the significant value and impact of the outcomes resulting from the DOE Office of Science's investments in national security," Hongyou said. He also acknowledged the support from Sandia's Laboratory Directed Research and Development program.

Recognizing a legacy of achievement

Over the past 20 years, Hongyou has received nearly one award each year for his contributions to science. In addition to the MRS Medal, he has been named a fellow of the American Physical Society, the American Chemical Society and the Materials Research Society. He received the MRS Fred Kavli Distinguished Lectureship in Nanoscience in 2015 and has been recognized for his mentorship of graduate students.

His accolades include Sandia's Laboratory Directed Research and Development Award for Excellence in 2007, six R&D 100 Awards for innovative technologies from 2007 to 2022 and the Asian American Engineer of the Year Award in 2012. Recently, the New Mexico Legislature honored him for his scientific and entrepreneurial contributions.

Hongyou Fan offers tools of success for other scientists

Early-career scientists often find it tough to get noticed in the competitive arena of scientific research. In a recent interview with Lab News, Hongyou Fan shared his insights on navigating these challenges and building a fulfilling research career.

Hongyou emphasizes the importance of tackling significant challenges. "Identify problems that matter," he said. "Look for gaps in existing knowledge that haven't been addressed yet." By keeping an eye on emerging trends, researchers can pinpoint areas ripe for innovation.

For Hongyou, this meant diving deep into the mysteries of nanoparticles. "How closely can they approach each other? Can they make contact? What happens if they do?" These questions led to groundbreaking discoveries about nanoparticle behavior and the creation of a pressure-induced assembly method.

"Solving real-world problems often results in impactful outcomes like influential publications, patents or industrial applications," he said.

In a profession where the pressure to publish can be intense, Hongyou champions quality over quantity. "Early in your career, it's easy to feel the need to publish frequently, but focusing on groundbreaking work is far more rewarding," he said. His first paper on high-pressure nanomaterials assembly took more than three years to publish but opened new research avenues and led to patented technologies.

Engaging with the scientific community is crucial, says Hongyou. Attending and presenting at conferences helps build a reputation and forge connections. "Conferences provide a platform to showcase your research and exchange ideas," he said. He encourages researchers to present their work, even if it's still in the early stages. Organizing symposiums on specific topics can boost visibility and establish researchers as thought leaders. "Facilitating knowledge sharing increases your profile and can lead to new collaborations," he said. Networking at these events can pave the way for joint projects and co-authorships.

Hongyou also underscores the value of interdisciplinary collaboration. Working with experts from diverse fields can spark innovative solutions that might not emerge within a single discipline. His partnership with Sandia's pulsed power team, for example, allowed them to explore ultrafast nanomaterials manufacturing — a breakthrough none could have achieved alone. "By leveraging each other's strengths, we tackled complex problems more effectively," he said.

Strategic partnerships with institutions that offer complementary resources can further boost research efforts. Hongyou's collaboration with synchrotron teams accelerated their understanding of material structures under pressure, drawing greater attention to their work.

Persistence is key when facing setbacks, according to Hongyou. "Recognition and success don't come easily or overnight," he said. He recalled the challenges he faced, including multiple rejections before publishing his first papers. "Each setback taught us valuable lessons. Don't be discouraged by early challenges; keep refining your approach," he said.

Focusing on long-term goals is essential for building a successful research career, he added. "Successful careers are built over time through consistent effort and a willingness to learn from failures," Hongyou said. "Patience combined with persistence ultimately leads to breakthroughs and recognition."

Leaking qubits

CONTINUED FROM PAGE 1

a practical way to detect these "leakage errors" for neutral-atom platforms. This achievement removes a major roadblock for one branch of quantum computing, bringing scientists closer to realizing the technology's full potential. Many experts believe quantum computers will help reveal truths about the universe that are impossible to glean with current technology.

"We can now detect the loss of an atom without disturbing its quantum state," said Yuan-Yu Jau, Sandia atomic physicist and principal investigator of the experiment team.

In a paper recently published in the journal PRX Quantum, the team reports its circuit-based method achieved 93.4% accuracy. The detection method enables researchers to flag and correct errors.

The research was supported by Sandia's Laboratory Directed Research and Development program.

Detection heads off a looming crisis

Atoms are squirrely little things. Scientists control them in some quantum computers by freezing them at just above absolute zero, about minus-460 degrees Fahrenheit. A thousandth of a degree too warm and they spring free. Even at the right temperature, they can escape through random chance.

If an atom slips away in the middle of a calculation, "The result can be completely useless. It's like garbage," Yuan-Yu said.

A detection scheme can tell researchers whether they can trust the result and could lead to a way of correcting errors by filling in detected gaps.

Matthew Chow, who led the research, said atom loss is a manageable nuisance in small-scale machines because they have relatively few qubits, so the odds of losing one at any given moment are generally small.

But the future has been looking bleak. Useful quantum computers will need millions of qubits. With so many, the odds of losing them mid-program spikes. Atoms would be silently walking off the jobsite en masse, leaving scientists with the futile task of trying to use a computer that is literally vanishing before their eyes.

"This is super important because if we don't have a solution for this, I don't think there's a way to keep moving forward," Yuan-Yu said.

Researchers have found ways to detect atom loss and other kinds of leakage errors in different quantum computing platforms, like those using electrically charged atoms, called trapped ion qubits, instead of neutral ones. The New Mexico-based team is the first to non-destructively detect atom loss in neutral-atom systems. By implementing simple circuit-based techniques to detect leakage errors, the team is helping avert the crisis of uncontrollable future leakage.

Just don't look

The dilemma of detecting atom loss is that scientists cannot look at the atoms they need to preserve during computation.

"Quantum calculations are extremely fragile," Yuan-Yu said.

The operation falls apart if researchers do anything at all to observe the state of a qubit while it's working.

Austrian physicist Erwin Schrödinger famously compared this concept to having a cat inside a box with something that will randomly kill it. According to quantum physics, Schrödinger explained, the cat can be thought of as simultaneously dead and alive until you open the box.

"It's very easy to have a mathematical description of everything in terms of quantum computing. But to visualize entangled quantum information, it's hard," Yuan-Yu said.

So how do you check that an atom is in the processor without observing it?

"The idea is analogous to having Schrödinger's cat in a box, and putting that box on a scale, where the weight of the box tells you whether or not there's a cat, but it doesn't tell you whether the cat's dead or alive," Chow said.

Surprise finding fuels breakthrough

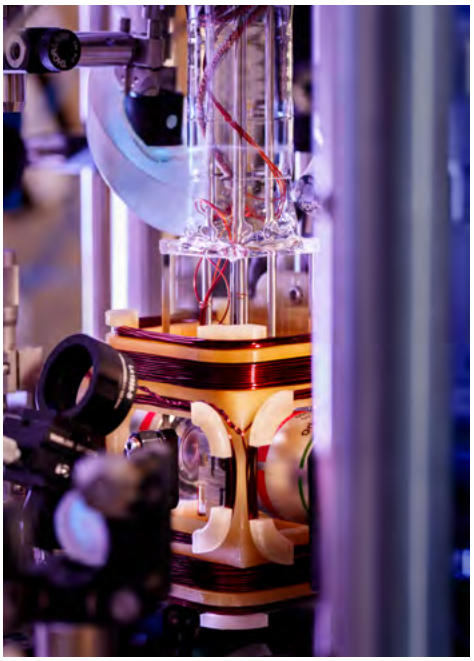
Chow, a University of New Mexico doctoral student and Sandia intern at the time of the research, said he never expected this breakthrough.

CAT'S CRADLE — Erwin Schrödinger used the analogy of a cat in a box to illustrate the fragile nature of quantum states, which collapse upon observation. But atoms, like cats, can escape. Researchers at Sandia and the University of New Mexico developed a method to monitor neutral atom qubits in a processor without collapsing their quantum states. Their technique is like placing the box on a scale that shows whether the cat is still inside while keeping it closed.

Illustration by Ray Johnson

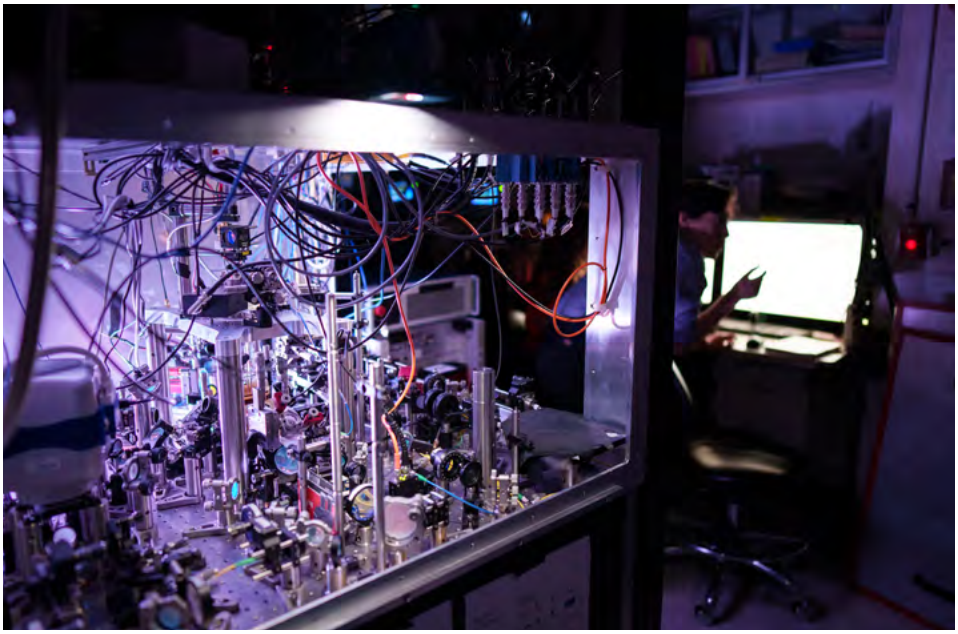
"This was certainly not a paper that we had planned to write," he said.

He was debugging a small bit of quantum computing code at Sandia for his dissertation. The code diagnoses the entangling interaction — a unique quantum process that links the states of



VACUUM CHAMBER — Objective lenses on either side of the vacuum chamber are used to focus laser light into single-atom traps at Sandia.

Photo by Craig Fritz



QUANTUM LAB — The central part of Sandia's neutral-atom quantum computing apparatus, pictured here, includes a vacuum chamber and surrounding optics for trapping and controlling individual cesium atoms. **Photo by Craig Fritz**

atoms — by repeatedly applying an operation and comparing the results when two atoms interact versus when only one atom is present. When the atoms interact, the repeated application of the operation makes them switch between entangled and disentangled states. In this comparison, he observed a key pattern.

Every other run, when the atoms were disentangled, the outcome for the two-atom case was markedly different from the solo-atom case.

Without trying, Chow realized, he had found a subtle signal to indicate a neighboring atom was present in a quantum computer without observing it directly. The oscillating measurement was the scale to measure whether the cat is still in the box.

"This was the thing that got me really excited — that made me show it to Vikas."

Vikas Buchemmavari, another doctoral student at UNM and a frequent collaborator, knew more quantum theory than Chow. He works in a research group led by the director of UNM's Center for Quantum Information and Control, Ivan Deutsch.

"I was simultaneously very impressed by the gate quality and very excited about what the idea meant: We could detect if the atom was there or not without damaging the information in it," Buchemmavari said.

Sandia verifies technique

He went to work formalizing the idea into a set of code tailored to detect atom loss. It would use a second atom, not involved in any calculation, to indirectly detect whether an atom of interest is missing.

"Quantum systems are very error-prone. To build useful quantum computers, we need quantum error correction techniques that correct the errors and make the calculations reliable. Atom loss — and leakage errors — are some of the worst kinds of errors to deal with," he said.

The two then developed ways to test their idea.

"You need to test not only your ability to detect an atom, but to detect an atom that starts in many different states," Chow said. "And then the second part is to check that it doesn't disturb that state of the first atom."

Chow's Sandia team jumped onboard, too, helping test the new routine and verify its results by comparing them to a method of directly observing the atoms.

"We had the capability at Sandia to verify it was working because we have this measurement where we can say the atom is in the one state or the zero state or it's gone. A lot of people don't have that third option," Sandia's Bethany Little said.

A guide for correcting atom loss

Looking ahead, Buchemmavari said, "We hope this work serves as a guide for other groups implementing these techniques to overcome these errors in their systems. We also hope this spurs deeper research into the advantages and trade-offs of these techniques in real systems."

Chow, who has since earned his doctoral degree and now works at HRL Laboratories, said he is proud of the discovery because it shows the problem of atom loss is solvable, even if future quantum computers do not use his exact method.

"If you're careful to keep your eyes open, you might spot something really useful."

Captured CO2

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Machinable, larger-scale, self-healing RHEAs

Sal Rodriguez faced an unexpected challenge four years ago when he tried to enlarge samples of superalloys known as refractory high-entropy alloys: they broke.

"This is not supposed to happen," Sal thought.

RHEAs were developed by aerospace engineers who needed high-temperature, high-strength materials for extreme environments. Despite their impressive melting temperatures — among the highest in the periodic table — and extraordinary strength, Sal's team discovered that about 99% of RHEAs are brittle at room temperature, making them difficult to machine as they shatter like glass when drilled or cut.

"We were excited when we first manufactured our RHEAs," Sal said. "What a disappointment to create alloys that can reach temperatures in excess of 2,000 Kelvin (about 3,140 degrees Fahrenheit) while retaining structural integrity, yet most were not machinable."

Rather than abandon the project, Sal focused on the elusive 1% of RHEAs that exhibited ductility.

"The goal is to turn this technology into a multi-billion-dollar industry in critical areas such as energy, aerospace and electronics," Sal said. "Because the field is so new, most research has focused on nano-, micro- and millimeter-scale RHEA samples, making it challenging to scale up for commercial applications. Just the same, we decided to see if we could find what we needed in the non-brittle 1%."

Through years of testing, Sal's team identified two key factors. On the downside, increasing the length revealed the impact of crystalline structures called material grains, which diminished material properties at larger scales. "Once we increased the manufacturing length to a few millimeters and centimeters, the RHEAs began breaking apart due to manufacturing stresses and impurities," he said.

Conversely, in their heated, liquid state, the RHEAs exhibited potential for turbulence and swirl that enhanced the mixture of elements.

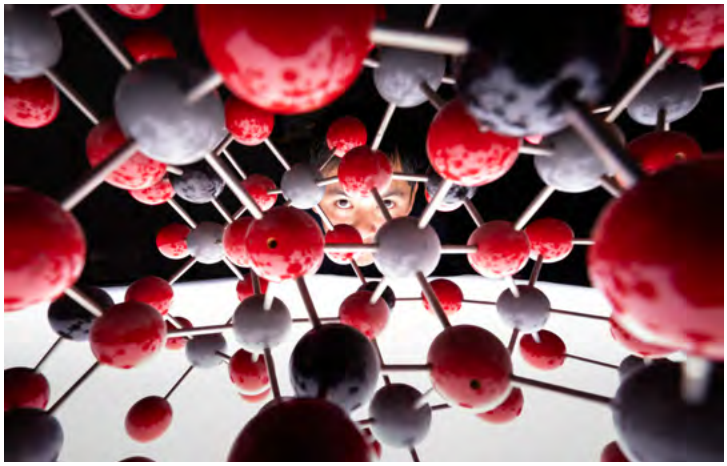
"After years of research and continuous improvement, we have demonstrated game-changing technology," Sal said.

The team continuously redesigned, re-manufactured and re-tested RHEA samples. "As we observed what worked and what did not, we developed novel element combinations and advanced manufacturing parameters, extending the length scale, ductility, endurance under harsh environments, material quality and machinability of our RHEA components."

Their efforts culminated in a homogeneous, micro-crack-free, highly machinable RHEA that set world records for both length and mass — 10.3 inches and 7.72 pounds — smashing previous records of 2 inches and about a quarter pound. Additionally, they demonstrated self-healing at the macro-scale and corrosion resistance in nuclear molten salts at a world record temperature of 965 degrees Celsius (1,769 F).

"Our work has attracted the attention of several large companies," Sal said, mentioning Northrop Grumman Corp. in San Diego, Dynetics Corp. in Huntsville, Alabama, and Albuquerque's Westwind Computer Products Inc., which specializes in advanced alloy manufacturing.

The project received support from the DOE Technical Commercialization Office. Other Sandia researchers instrumental in the project were Rob Sharpe, Moises Beato, Mark Rodriguez and the Molten Salts team. Other collaborators included California Nanotechnologies, DRS Research, Plasma Technology Inc., Applied Surface Engineering and the University of New Mexico.



CATCHING CARBON — Researcher Tuan Ho has developed a simple and inexpensive method for capturing atmospheric carbon dioxide, thought to be a key contributor to climate change. **Photo by Craig Fritz**

Low-cost direct air capture of CO2 with clay nanointerlayers

Tuan Ho and his team have developed a remarkably simple and potentially inexpensive method that relies on basic materials properties and a little chemistry to capture atmospheric carbon dioxide, thought to be a key contributor to climate change.

"Stabilizing CO2 emission levels while supporting economic development is essential for a sustainable future," Tuan said.

While capturing CO2 from point sources like coal-fired power plants is an obvious strategy, current carbon-capture technologies often require extensive energy infrastructure, such as pipelines for CO2 transport. In contrast, direct air capture technology is more portable and easily distributed, making it suitable for a variety of locations.

However, existing methods typically rely on strong chemical bonding, requiring energy intensive, high-temperature treatment of around 900 degrees Celsius (1,652 F) for CO2 release and material regeneration.

The Sandia technology, however, is based on weak chemical interactions of CO2 with an aqueous solution confined in nanoscale interlayers of expansive clay. The approach relies on three key components: manipulable clay nanoscale interlayers, the enhanced solubility of nanoconfined CO2 compared to bulk water and rapid nanofluidic flow within the interlayers.

Instead of temperature swings, this technology uses humidity changes to capture and regenerate materials, making the process less costly and energy intensive.

First, air or flue gas is introduced into a clay column at high relative humidity,

causing the clay to expand and open nanoscale interlayers for CO2 uptake. The measured CO2 uptake in clay interlayers can be 55 times higher than in bulk water. Regeneration occurs by flowing dry CO2 through the material, reducing relative humidity and collapsing the clay so it releases both water vapor and dissolved CO2. The clay is then ready for the next cycle.

Tuan's Sandia research team included Yifeng Wang, Susan Rempe, Guangping Xu, Timothy Zwier, Melissa Mills, Eric Coker, Carlos Jove-Colon and Nabankur Dasgupta, in collaboration with Professor Cliff Johnston at Purdue University.

The idea stemmed from the team's expertise in such fundamental science areas as nanoconfinement, clay minerals and CO2 capture and in computational and experimental methods.

"We intend to continue exploring the fundamental scientific questions that have emerged during this project, advancing the field of CO2 capture and contributing to sustainable solutions for climate change," Tuan said.

The research was funded by Sandia's Earth Science Laboratory Directed Research and Development investment area.

Society of Women Engineers honors Sandia materials scientist

Erica Redline recognized nationally for her mentoring leadership

By **Luke Frank**

Erica Redline has dedicated more than 10 years at Sandia Labs to advancing polymer science by developing next-generation materials, including those that withstand extreme environments to significantly improve the durability of photovoltaic solar panels. A principal member of the technical staff in the Special Technologies Department, she is widely published and holds four U.S. patents, with five more pending.

Throughout her career, Erica has inspired hundreds of middle and high school students, as well as university students, to explore STEM fields. Her commitment to mentorship earned her the international Ignite Award from the Society of Women Engineers, recognizing her contributions to advancing women in STEM.

Erica's journey as a mentor began as an undergraduate student at Penn State, where she tutored students in an introductory biology course. She later mentored high school students at Penn State's Materials Science Summer Camp. Erica said these experiences were life-changing and emphasized for her the importance of outreach activities to expose young women to STEM majors.

As a first-generation college student from a small blue-collar town, Erica wished she had encountered a role model in high school who could illustrate the possibilities of a STEM degree. "When I was a student, I had no idea the breadth of STEM careers out there," she recalled. "I had four years to get a degree — that's what my budget would cover. Having a mentor might have helped me find and focus on my career in engineering and materials science much earlier."

As an advocate for women in STEM, Erica has collaborated with Girl Scouts, judged the New Mexico Science Bowl, and led activities for Manos, a hands-on program led by Sandia's Hispanic Outreach for Leadership and Awareness. She also has co-developed interactive science demonstrations for Sandia's Take Your Kids to Work Day and co-taught a Sandia course on Hands-On Minds-On Technology for local students, which utilized Sandia's dognapping curriculum to introduce students to forensic science.

Erica has worked closely with the University of Minnesota's Council for the Advancement of Underrepresented Scientists and Engineers, or CAUSE, an organization that focuses on recruiting, retaining and professionally developing science and engineering graduate students of color and first-generation college students. She has appeared on 3M's Champions of Science Podcast, mentored students through the University of New Mexico's Upward Bound Program for college-bound high school students and served as a career mentor in various professional organizations.

FLAME ON — Sandia Labs engineer Erica Redline recently received the Society of Women Engineers international Ignite Award for her advocacy and mentorship of women in STEM.

Photo by Craig Fritz

Recently, Erica has shifted her focus to individual mentoring, aiming to create a lasting impact on university and professional women by helping them achieve their next-level STEM career goals.

"I think a one-on-one experience is

more impactful," she said. "Advocating for groups gives me just one opportunity in front of a lot of people, but one-on-one mentoring can really make a difference. I feel I can do more than generate a spark to get women into a STEM pipeline. I can help keep them in the pipeline and create the next generation of mentors to inspire younger scientists and engineers."

The Society of Women Engineers advances and honors the contributions of women at all stages of their careers. SWE recognizes the successes of its members, individuals, allies and employers who enhance the engineering profession through contributions to industry, education and the community. The Ignite Award honors individuals who have significantly contributed to the advancement of women by mentoring those around them.

Immersing in Sandia's mission

Sandia hosts Air Force captain for fellowship

By **Kenny Vigil**

U.S. Air Force Capt. Joshua Widick is getting a deep dive into Sandia's mission as part of the Air Force's Education with Industry. Joshua, who has more than 19 years of active-duty military experience in intelligence, weapon system maintenance, munition sustainment and explosive safety, is eager to learn and contribute during a 10-month sponsorship by Sandia's Military Liaison.

"The nuclear security enterprise might be in a renaissance, and it's pulling talent from many different places," Joshua said. "There are a lot of up-and-coming folks in the enterprise and that's very heartening."

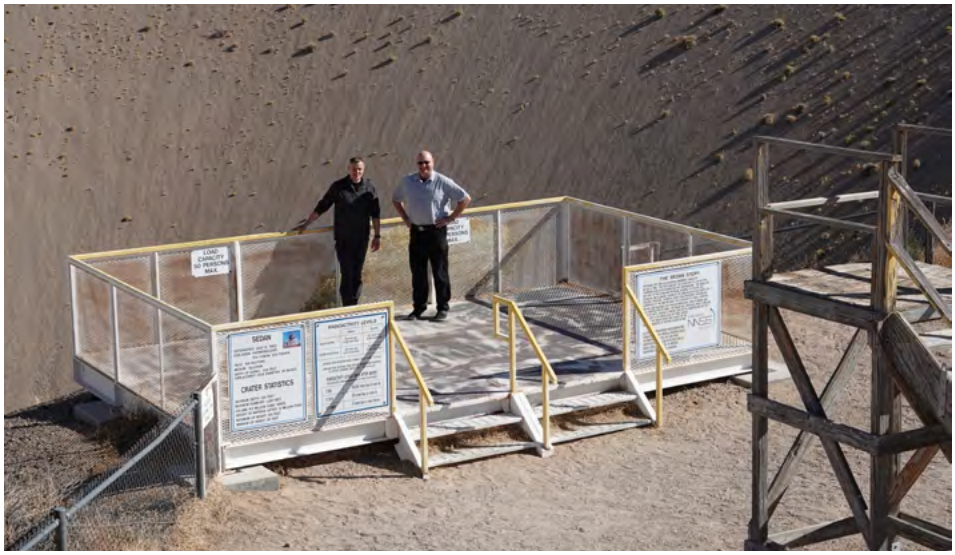
Joshua is particularly interested in how organizations identify and maintain talent. "I do a lot of talent management, and I try to motivate others to see the bigger picture," he said.

He finds it fascinating to observe how NNSA design and production agencies contribute to the overall nuclear posture. In the first few months of his fellowship, he has visited the Nevada National Security Site, Savannah River Site and the Kansas City National Security Campus.

"Everywhere I've gone, the leadership team wants to share insight and wisdom. They're really invested in the mentorship aspect. That's amazing to see," Joshua said.

Fellowship history

This is the fifth year Sandia has sponsored an Education with Industry fellow.



LEARNING EXCURSION — Sandia fellow Joshua Widick, left, and Sandia systems engineer Mark Meyer visit Sedan Crater during a trip to the Nevada National Security Site.

Photo courtesy of the Nevada National Security Site

"Joshua has already contributed to all three Military Liaison mission areas of field engineers, technical publications and training," said Mark Meyer, a systems engineer and Joshua's Sandia coordinator. "Through this fellowship, Joshua has personally trained over 350 students from all over the U.S. nuclear security enterprise."

Education with Industry began in 1947, the same year the Air Force was established. The program sends Air Force officers and enlisted personnel on a 10-month career-broadening tour with a selected company to learn cutting-edge technology and innovative management processes. More than 40 companies, including Boeing, Delta Air Lines Inc. and Google, are supporting this year's class. The students were selected through a highly competitive process.

Relationship-building

When Joshua completes the fellowship, he anticipates he will become the director of operations for a munitions squadron.

"During my time at Sandia, I have established relationships about who I need to talk to. That's priceless," he said. "Communication is more effective when you have relationships and that makes it easier to solve problems."

Mark has taken notice of Joshua's outstanding relationship-building skills. "In his short time here, Joshua has used his almost 20 years of experience in the Air Force to leverage professional connections and personal relationships all over the Labs," he said.

Sandians interested in assisting with Joshua's training can find his contact information in the Labs' employee directory.

Sandia Blade Workshop celebrates 20 years

Wind industry seeks 'new balance' as result of growth

By **Kelly Sullivan**

Industry, academic and governmental stakeholders converged in Albuquerque for the 2024 Sandia Blade Workshop. The biennial event, established in 2004, marked its 20th year addressing major topics related to wind turbine blades and promoting interaction and networking.

"There is continual pressure to increase the reliability of wind turbine blades while also innovating to drive down costs. These competing pressures offer a prime role for continuing rapid innovation of wind turbine blade technology," Sandia wind researcher David Maniaci and this year's workshop chair, said. "We're no longer just designing turbines for initial cost, but environmental, social and life-cycle drivers as well. The industry has rapidly grown, and there is a tension between growth, cost and reliability that is finding a new balance."

Keynote speaker Eric Lantz, director of the DOE Wind Energy Technologies Office, kicked off the September workshop by providing conferencegoers with an overview of the government's wind research program and strategy. WETO targets foundational science, enabling industry to advance, test and demonstrate technological solutions. These investments have led to advancements that have lowered the cost of offshore and onshore wind energy; however, Lantz underscored the need for more wind turbines, with processes that address wildlife and community needs, as well as the grid services benefit that wind provides, such as voltage and frequency support.

CLOSE INSPECTION — Sandia wind researchers Brent Houchens, left, and Dan Houck discuss structural properties of a 3D-printed blade tip. **Photo by Craig Fritz**

Over the course of the week, more than 180 attendees engaged in 12 panel and technical discussions sharing input on common challenges and opportunities related to wind turbine blade technology. World-renowned wind energy experts offered technical deep dives on state-of-the-art wind turbine blade design, manufacturing, operations and maintenance. Workshop side meetings — smaller, interactive meetings covering topics like blade modeling tools, community interaction, blade reliability, operations, maintenance and leading-edge erosion — offered attendees with similar interests the chance to meet in more informal settings.

This year's Growth vs. Reliability and Owner Operator panel sessions were the most attended, highlighting the major challenges the wind industry faces today to scale up wind turbine blades while responding to calls to further reduce costs. Lightning mitigation and sensing systems for blades were also hot topics, generating considerable stakeholder discussion. "There is still a lot of room for innovation as our understanding of the physics of lightning grows," David said.

PANEL DISCUSSION — Sandia researcher and event chair David Maniaci opens the 2024 Sandia Blade Workshop. **Photo by Craig Fritz**

Plans are already underway for the 2026 Sandia Blade Workshop. Looking ahead, popular topics for further consideration include advances in leading-edge blade-protection technology, deployment of robotic blade-repair systems, scaling blade designs and manufacturing while responding to cost and reliability pressures and innovative methods for inspecting blades during their life-cycle stages.

"We look forward to gathering again in 2026 as wind turbine blade technology continues to evolve as fast as the industry that drives it," David said.

Read more about the **blade reliability experts and view their workshop presentations**.

Learn more about Sandia's Wind Energy Technologies program's **capabilities and research**.

Sandia podcast awarded

'Inside Sandia Podcast' wins gold at New Mexico Public Relations Society of America's Cumbre Awards

By **Myles Copeland**

Explosions. Exoskeletons. Hypersonic speed. Metals that heal like skin.

These could be the elements of a Marvel blockbuster. Or just a typical day at Sandia.

But throw in cute burrowing owls, green chile roasted with solar power and career advice from top executives and you have the makings of an award-winning podcast.

The Labs Inside Sandia Podcast, which chronicled these topics and more since debuting in August 2023 as a new way for Sandia to communicate with its employees, claimed a Gold Award for Tactic — Podcast at the New Mexico Public Relations Society of America's Cumbre Awards. The awards were held Nov. 7 at Albuquerque's Route 66 Hotel.

Sandia claimed two other Cumbre Awards:

- Our Purpose Presentation Survey (Gold Award for Tactic — Research/Evaluation)
- A Brighter Future Video (Silver Award for Tactic — Videos)

The video was also a Platinum Winner of the 2024 Hermes Creative Awards. Administered by the Association of Marketing and Communications Professionals, the Hermes awards evaluate the creative industry's best publications, websites, videos and more.

The podcast was launched after 45% of respondents in a 2023 Communications survey said they would be likely to listen to a podcast for Sandians, said Heather Clark, senior manager of Communications.

"With no additional funding or staff, this talented team took it from there, creating an engaging, new way for Sandia to tell its mission and other stories to the workforce," Heather said. "It's wonderful to see this team build a quality product and receive recognition from communications experts outside Sandia for their excellent work."

THEY'RE GOLDEN — Members of the Inside Sandia Podcast team, from left, Sheina MacCormic, Troy Rummler and Scott Faulk accept the Gold Award at the New Mexico Public Relations Society of America's Cumbre Awards at Route 66 Hotel on Nov. 7. Scott is holding the certificate of colleague Todd Perchert. **Photo by Carey Tully, NMPRSA**

Kim Vallez Quintana, a corporate communications specialist and frequent host of the podcast, was part of recording an episode at Sandia's explosives test field.

"There's always this intrigue about that area, like, 'what do they do out there?'" she said. "We have the opportunity to take our listeners into places that maybe they wouldn't visit normally."

Kim and corporate communications specialist Troy Rummler took listeners along with Sandia volunteers who supported the DOE High School Regional Science Bowl at the Albuquerque Academy in March.

"To step into that world for a day, capture it and share it, that was fun," Troy said. "There was a lot of energy in the room. Kids were buzzed and excited. The volunteers were happy to be there, and some of them had a history of doing science bowls as a kid. Sandia was going out into the community and making an impact — not just in a scientific way but helping kids and being part of their excitement for science. It was not a world that I had been part of."

The hosts have enjoyed a front-row seat as Sandians shared the excitement they have for their technical work.

"Andrew Landahl is a great example," Troy said. "He works in quantum information science and he loves to talk about quantum computing. It's more than just a job for him. It's a passion."

"Learning the stories of how people came to work at Sandia and their backgrounds has been really interesting and fun," Kim said. "One person that comes to mind is Sal Rodriguez (who was named 2023 Hispanic Engineer National Achievement Awards Conference Scientist of the Year). Sal is the son of immigrants; he was this kid who used to work in the fields with his family and then went on to be a genius. You get to delve into who these people are, how they grew up, how they came to be what they are today."

Releasing new episodes every other week, the podcast benefited from contributions by a large team of communicators including Johann Snyder, Vince Gasparich, Sheina MacCormic, Katherine Beherec, Dan Ware, Alex Longo and Scott Faulk. Todd Perchert, who recently transferred to a technologist role at the Z Pulsed-Power Facility, also helped launch the podcast.

Tune in

Sandians can listen to more than 30 episodes of Inside Sandia Podcast and new shows every other week.

3-to-1 matchmaking transforms supplier outreach at Sandia and beyond

Innovative Methodologies

By **Hilary Zwahlen**

Sandia's Small Business Outreach team is enhancing connections between suppliers and potential buyers through innovative 3-to-1 matchmaking sessions. This model is being adopted by other DOE national laboratories.

Out with the old, in with the efficient

Historically, outreach sessions were one-on-one meetings, which, while valuable, were time-consuming and limited the number of meaningful connections that could be made with small-business suppliers. Recognizing the need for a more efficient approach, Patricia Brown and Megan Weaver from the Small Business Outreach team revamped the matchmaking process to maximize impact for small-business owners while being mindful of buyer bandwidth.

The main challenge of the one-on-one model was that participants had limited time for matchmaking sessions. Patricia and Megan solved this by combining multiple suppliers with a single buyer in each session. The new format features 15-minute sessions with three suppliers and one buyer. This setup allows buyers to introduce themselves and their mission, while suppliers can ask questions, discuss capabilities and explore collaborations.

BETTER MATCHMAKING — From left to right, Brandi Abousleman, Royina Lopez, Marie Simms, Desiree Garcia, Zach Mikelson, Patricia Brown, Leo Valencia and Megan Weaver. **Photo by Bret Latter**

Feedback has been overwhelmingly positive. Suppliers appreciated meeting peers and discussing opportunities to work together, alleviating awkward networking pauses and fostering partnerships.

Future matches

With the success of the initial sessions, Sandia plans to continue the 3-to-1 format. This approach enhances the efficiency of supplier outreach and strengthens collaboration that is essential to achieving Sandia's mission.

Sandians can read more about the innovations of Mission Services.

Pushing the envelope

In June, DOE Office of Small and Disadvantaged Business Utilization Director Ron Pierce praised Sandia for coming up with the idea for reaching more small businesses through the 3-to-1 matchmaking sessions. At the DOE Small Business Forum & Expo, Director Pierce said, "Sandia is always pushing the envelope and thinking outside the box."

DOE Office of Small and Disadvantaged Business Utilization Director Ron Pierce

A comprehensive program

In addition to 3-to-1 matchmaking, the Sandia Mentor Protégé Program is setting the standard for how the nuclear security complex works with small businesses. At the expo, NNSA Small Business Program Manager Gary Lyttek expounded on Sandia's creativity and implementation. "They added structure and made it a win for everyone. It is now being looked at by the DOE to see if they can take the best of the Sandia program and make it theirs."

NNSA Small Business Program Manager Gary Lyttek

Bridging the gap between Sandia and HBCUs

By **Magdalena Krajewski**

Rahni Kellum is a doer.

And in 2020 when she noticed a gap within Sandia's Academic Alliance Program, she did a lot more than speak up.

At the time, Rahni was working in business development supporting the program's strategic research partnerships with five universities, the University of New Mexico, Georgia Institute of Technology, University of Texas at Austin, Purdue University and the University of Illinois.

"As I matured in my role, I realized we didn't have any relationships with historically Black colleges and universities," Rahni said. "While we did recruit from HBCUs, we didn't have that strategic research tie like we did with the Academic Alliance Program, which is how we create those mutually beneficial relationships."

Because of Rahni's work in business development, she knew just how important those relationships could be for a university. Especially for an HBCU.

"HBCUs are historically underfunded and under resourced," Rahni, a graduate of Prairie View A&M, one of nine HCBUs in Texas, said. "These schools don't have the same name recognition some of the larger institutions do, and so there can be a stereotype that the caliber of students who come from these schools is going to be less than students graduating from predominately white institutions."

Launching START HBCU

Committed to redefining stereotypes and championing for HBCUs, Rahni got to work.

"My first step was to partner with Sandia's Black Leadership Committee," Rahni said. "They had been pushing for Sandia to have bigger investments with HBCUs for a while and because of my work with the existing academic partnerships, I was able to take those ideas and put them into context and create a plan."

Rahni worked with the Black Leadership Committee to create a proposal that would go in front of Susan Seestrom, who at the time was the associate Labs director for Advanced Science and Technology and the chief research officer.

"We were proposing the ability to create a program similar to the Academic Alliance Program, but specific to HBCUs," Rahni said.

In February 2020, Rahni met with Susan, pitched the proposal and got the green light.

"Susan liked the idea," Rahni said. "She asked me to formalize the program, decide which schools to engage, gain their buy in and bring everything to fruition."

CHANGEMAKER — Rahni Kellum was at the helm of developing the Securing Top Academic Research and Talent with historically Black colleges and universities at Sandia.

Photo by Ronald Hanson, Kansas City National Security Campus

Global pandemic aside, Rahni made it happen.

Working alongside the Black Leadership Committee and the University Research Association department, Rahni selected schools based on how well their capabilities matched with Sandia's needs and existing relationships already developed on the recruiting side.

In October 2020, the Securing Top Academic Research and Talent with HBCU program, also known as START HBCU, officially kicked off with partnerships with Florida A&M University, North Carolina Agricultural and Technical State University, Norfolk State University, Alabama A&M University and Rahni's alma mater, Prairie View A&M University.

Rahni managed the program, all five HBCU relationships and START's internship institute until 2023 when she became an equal employment opportunity specialist. Rahni has recently been appointed a distinguished Human Resources strategic specialist.

Anthony Sanders currently manages the START program, which has 15 active research collaborations across the five HBCUs.

Rahni's 'why'

A graduate of an HBCU herself, Rahni has a deep love and appreciation for what she sees as the families created within HBCUs.

"I love the community and comradery developed at these schools," Rahni said. "These communities become like family. There are over 100 HBCUs in the country, and I can meet someone who went to a different HBCU in a totally different part of the country, and we'll have this instant connection, like we're all cousins."

And as Rahni said, you want to lift your family up however you can.

"While the START program is focused on our intern pipeline, the research collaboration between Sandia and these schools really helps elevate their profiles," Rahni said. "These relationships foster long-term, meaningful connections, specifically with the faculty. And if we think about a university like a body, where students are the blood, they flow in and out, the faculty is the veins, these are the relationships we need to nourish.

"These partnerships also help expose students to the work we do at the Labs. It's one thing to see Sandia at a career fair, but to be in a classroom and see your professor working on a Sandia project, that's a front row seat, which helps students see the kind of work they could be doing at the Labs one day."

So far, START seems to be working. Anthony says that there has been a 69% increase between 2023 and 2024 in the number of interns onboarded from HBCUs.

"Historically, we know that interns become Sandia employees," Rahni said. "If we can get them in the door as interns

and find the right career fit, we can keep the pipeline going."

Getting it done

When Rahni started the groundwork to develop START HBCU, she was working two other jobs within Sandia. "It was a total stretch project," Rahni said.

But Rahni saw a place where Sandia needed to improve and so she raised her hand. "Sandia has been a place where I have been able to both find and make my way, and that's pretty special," Rahni said. "Part of this has been me taking the time to get to know Sandia. I realize we have our challenges, but getting to know what those mean for the organization and then finding ways to say, 'What are we going to do about it?' and then being able to step up and help make those changes.

"Other organizations might say, 'No, that's not what you were hired to do,' but here we have the ability to learn about ourselves, our passions and use those to fuel our careers to make a real difference in the world."

Points of connection

How a Sandia systems analyst connects the dots between climate change and disease

By **Sarah Jewel Johnson**

Everything on Earth is connected — knitted together in a fragile system, whose health is impacted by climate change.

For Sandia's Anthony Falzarano, there is little separation between plants, animals, humans and the global environment. Anthony spends his days as a systems analyst, working from rural southeastern Ohio, studying the links of interdependency between ecosystems and the subsequent relationship to the health of human populations.

"From the health-security perspective, climate change is obviously important and really hits on a lot of important things that we care about in our research space. You can think about it in a widespread way, for example, in terms of food security, heat stressors and water insecurity, but also my areas of expertise, biology and microbiology," Anthony said.

Anthony and his peers at Sandia support the Department of Homeland Security's Health, Food and Agricultural Resilience Directorate, which was formed after COVID-19 to better understand how human, environmental and animal health systems are interlinked. Anthony is specifically interested in the spread of zoonotic diseases, or infections that can be spread between animals and humans.

"We talk about climate change as being important in changing the ecology of certain diseases, of making new diseases more likely to emerge," Anthony said.

Anthony holds a master's degree in biodefense from George Mason University and a bachelor's degree in environmental microbiology from Ohio State University.

At times, climate change research and mitigation can be viewed through a broad, wide sweeping lens. However, Anthony's approach to climate change research focuses on how one tiny change can impact an entire ecosystem.

"Sometimes lesser, smaller things like just taking an organism that used to only live as far north as Maryland and now making it move or live as far north as New York can impact dynamics and ecology of whole systems. That small thing changes everything," Anthony said.

The One Health approach

Anthony's background in emergency response and health security is directly tied to the concept of a holistic, interwoven global environmental concept called One Health.

"One Health is a pretty contemporary idea in public health and health security," Anthony said. "At Sandia, we do a lot of work with customers who must interface with the Environmental Protection Agency, the United States Department of Agriculture and the Food and Drug Administration to look at how the health space, national security space and climate change intersect and how certain factors could make us vulnerable."

The Sandia team and others in the One Health space focus on putting knowledge and data collected from various sources into use to optimize health outcomes. For example, they research ways to use new infectious disease surveillance information that emerged from the COVID-19 pandemic.

CLIMATE CHAMP — Systems analyst Anthony Falzarano presents at the Battelle Innovations in Climate Resilience conference in Columbus, Ohio.
Photo courtesy of Anthony Falzarano

"All of a sudden (after COVID-19), everyone started doing wastewater surveillance and sampling environments and animals, but what do we do with the data? What does it mean to know that we saw COVID-19 in deer? Could that be a stressor down the road that could impact our ability to provide for ourselves and our people and our food and water security? Sandia is leading that work. As a nation, we must be aware of what climate change is going to mean for us in the future and our ability to compete and survive in a global space," Anthony said.

The systemic, holistic concept of One Health means everything on the globe is tied together and has the potential to impact something else. For Anthony, climate security and public health security are inextricably interconnected. Both ideas are based on evaluation of critical infrastructure, resiliency and mitigation of potential future stressors. Climate change coupled with health security is a complex problem to navigate, but Anthony believes the broad expertise cultivated at Sandia has the potential to make a difference.

"I would say the people, the capabilities and our reputation at Sandia are the most impactful things," Anthony said. "I don't know much about modeling or computers, but I do know that other Sandians can create sophisticated models of what could impact ecosystems. Those high-fidelity models could show us that spring thawing could happen quicker due to climate change, and then we could help our customers analyze what that would mean for our planting season, plant pathology and what could kill our crops."

Widespread impact

The interconnected nature of Anthony's work means he evaluates complex issues from various lenses and sources, sometimes predicting daunting global outcomes, but that doesn't deter him from the work. Instead, he aspires to share the data in an approachable way so that everyone understands how climate change impacts their lives.

"I went to school with a lot of people who went into medicine. You don't think of it as an impact to them, but it does. Your patients are going to be stressed by certain things and present illnesses in different ways, no matter which medical specialty you go into. If you're an infectious disease doctor, you might have to start wondering about different zoonotic diseases. If you're primary care, you're going to have to worry about medical, social inequity and all types of environmental exposures," Anthony said.

"There is this misconception that if (climate change) hasn't impacted you directly, you can insulate yourself from it forever, but eventually it will affect you either directly or indirectly," he said.

Anthony doesn't mean to be alarmist. Instead, his intent is to draw connections between how we live now and how we can mitigate, or at least plan for, future impacts to our ecosystems and security.

"It's all about awareness and advocacy," he said. "I would say climate change is the single greatest threat that we have ever faced as a planet."

Mileposts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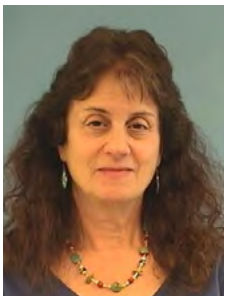
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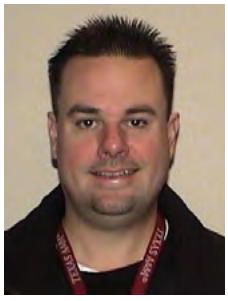
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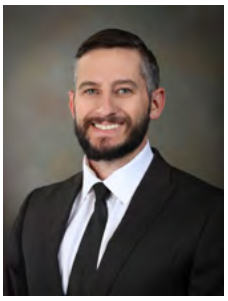
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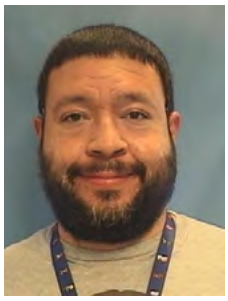
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