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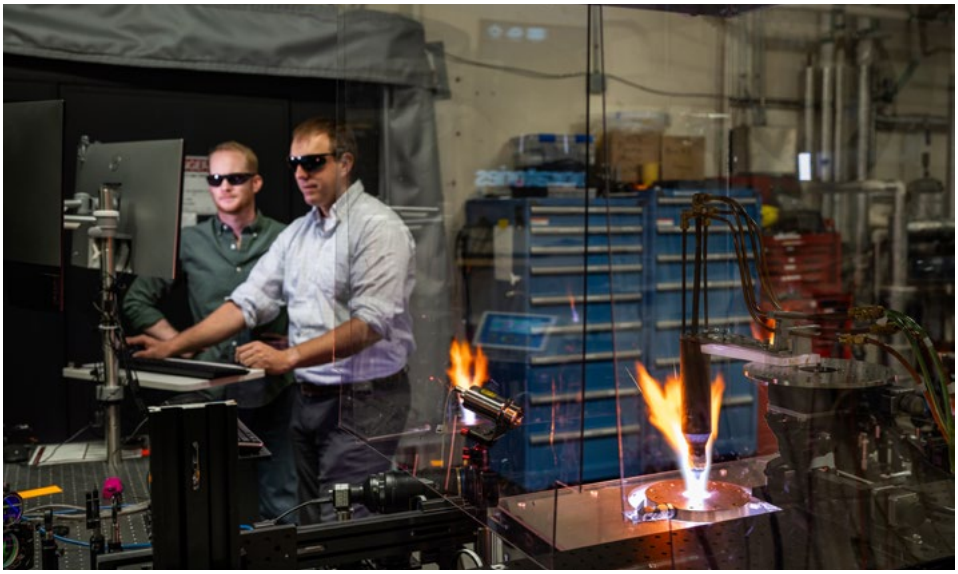
Electric car challenge adds AI **Page 11**

It is rocket science: New heat shields, faster



HOT STUFF — Sandia engineers test a thermal protection system material in an inductively coupled plasma torch. Material such as this protect hypersonic vehicles from the intense heat of traveling at more than 3,800 miles per hour. **Photo by Craig Fritz**

Computer models, experiments for rapid testing of hypersonic materials

By **Mollie Rappe**

From the tragedy of the space shuttle Columbia disaster in 2003 to the now-routine return of commercial spacecraft, heat shields — formally called thermal protection systems — are critical for protecting vehicles from the intense heat and friction of atmospheric reentry or traveling at many times the speed of sound.

Now, a team of Sandia engineers have developed ways to rapidly evaluate new thermal protection materials for hypersonic vehicles. Their three-year research project combined computer modeling, laboratory experiments and flight testing to better understand how heat shields behave under

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Three national security laboratories, one AI model

A federated-learning model prototype to enhance national security efforts

By **Shelby Owens**

A significant milestone has been not only accomplished but exceeded in the effort to advance artificial intelligence for national security. Over the past year, Sandia, Los Alamos and Lawrence Livermore national laboratories — known as the trilabs — have been building a federated-AI model as a pilot project, and they now have a prototype. Federated

— CONTINUED ON PAGE 5

ONE JOB ON THREE SYSTEMS — Sandia's, Los Alamos' and Lawrence Livermore's data are kept in three different places. A training run builds one model using those three different systems. Hops, pictured above, is one of the Sandia systems in the project. **Photo by Craig Fritz**

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Quantum computers get a boost from a tiny material tweak

LOOKING FOR CHANGE — Sandia's Chris Allemang contributed to research toward improving the performance of certain quantum computers. **Photo by Craig Fritz**

Researchers thought they might hinder electrical flow. Instead, they unleashed it.

By **Troy Rummler**

A small, counterintuitive tweak to advanced materials can improve how quantum computers hand off information inside their systems, making them more efficient, reliable and scalable.

In a paper recently published in Advanced Electronic Materials, a team from Sandia, the University of Arkansas and Dartmouth College found they improved the flow of electrical current through a specialized semiconductor device called a quantum well. This device is increasingly used to make telecommunications faster and more efficient, and researchers have been exploring if it can have the same impact on quantum computers.

To visualize a quantum well, imagine a marble rolling in a groove between two raised edges. The marble can only move back and forth. A quantum well controls electrical current in a similar way, confining it in an ultrathin layer of material. This confinement improves how quickly you can encode information in light.

The new paper shows how to make these wells work even better, whether for quicker downloads and smoother online experiences or for better qubits and more efficient transmission of quantum information.

Supported by a grant from the DOE's Office of Science, the study is part of the **Manipulation of Atomic Ordering for Manufacturing Semiconductors** initiative, a DOE Energy Frontier Research Center based at the University of Arkansas. This collaborative effort has involved Sandia and nine universities working together since 2022 to uncover the scientific principles that govern the arrangement of atoms in semiconductor alloys. By discovering and using these scientific principles, the μ-ATOMS team seeks to develop materials that advance semiconductor technologies.

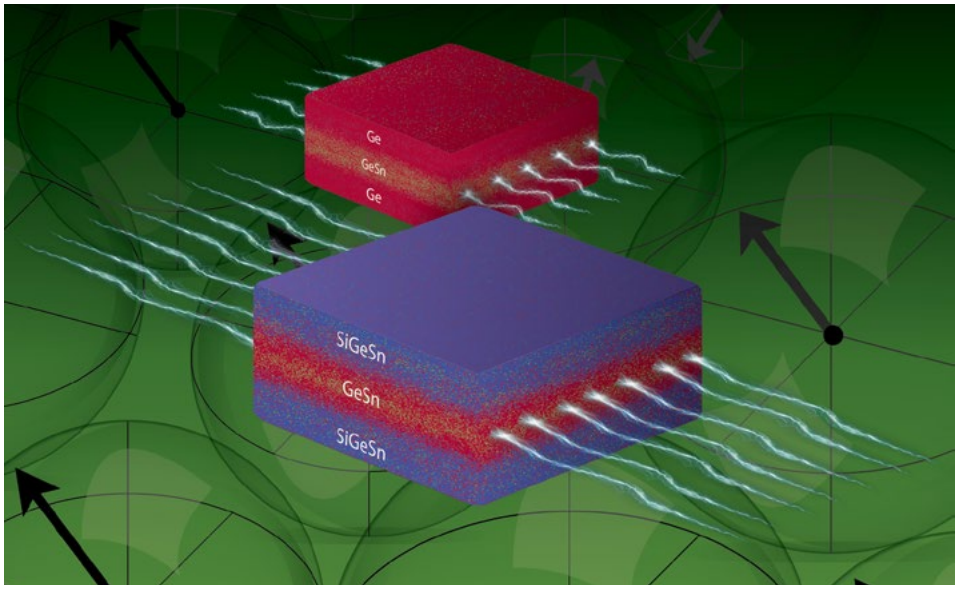
This newly published paper was led by the Sandia team at the Center for Integrated Nanotechnologies, an Office of Science user facility supporting national nanoscale science research, jointly operated by Sandia and Los Alamos national laboratories.

A little tin and silicon help the current glide

Most studies on the same type of quantum well this team used have focused on barriers that are made of pure germanium to keep electrical current confined. Unexpectedly, the improvement the team reported came from adding two impurities, tin and silicon.

This challenges previous assumptions that adding impurities would only slow electricity down, like adding bumps in the marble track. But remarkably, instead of getting in the way, the presence of tin and silicon may have made energy roll through the quantum well more efficiently. Scientists measured an increase in an electrical transport characteristic called mobility.

"We thought it would be worse because we mixed things together. But we found the mobility is higher," said Shui-Qing "Fisher" Yu, professor of electrical engineering and computer science at the University of Arkansas and a lead investigator on the study.



INCREASED MOBILITY — An illustration of two quantum wells. Researchers found that by adding small amounts of silicon and tin to the outer barriers, they increased the mobility of charge carriers passing through the middle. **Image courtesy of the University of Arkansas**

That surprising boost in mobility suggests that tiny patterns in how atoms arrange themselves, called short-range order, may be helping, rather than hindering, the flow of current.

Sandia's Chris Allemang, the first author on the paper, added, "The unexpected high mobility result hints at short-range order effects in the Group-IV silicon-germanium-tin system, which is particularly exciting due to the system's optical properties and its potential for monolithic integration with conventional silicon CMOS. This short-range order may provide an additional control knob, beyond alloying and strain, for engineering material properties that will impact national priorities in microelectronics and quantum information science."

Nanometers thick but full of possibilities

The collaboration explored the effects of silicon-germanium-tin barriers to better understand how different materials can enhance performance. The University of Arkansas produced the high-quality quantum well material that Sandia used to build experimental devices and then analyzed their electrical performance. Dartmouth College examined the atomic short-range ordering in the silicon-germanium-tin barriers to gain insights into their electrical behavior.

Recent research from Lawrence Berkeley National Laboratory and George Washington University has revealed that trace elements in semiconductors, such as silicon and tin, exhibit short-range ordering. This means that these elements do not scatter randomly but instead arrange themselves in relation to the main material.

Short-range ordering could explain why the silicon-germanium-tin barriers produced a quantum well with higher mobility. If further research confirms this hypothesis, it could open new avenues for manipulating atomic arrangements to dramatically enhance performance.

"It is exciting to reveal the potential impact of atomic short-range ordering on the electrical performance of quantum wells," said Jifeng Liu from Dartmouth College, a co-author of the study. "It offers a new degree of freedom for device engineering."

Yu said, "Even on that tiny scale, on the order of a nanometer, you still have hundreds of thousands or millions of atoms. That means you have a larger room to play to enhance the property."

Taken together, the results point to new ways of designing semiconductor materials that could benefit both conventional microelectronics and emerging quantum information systems.

Rocket science

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extreme temperatures and pressures, and to predict their performance much faster than before.

Hypersonic flight means traveling at speeds of at least five times faster than the speed of sound, or more than 3,800 miles per hour. Other vehicles, such as ballistic missiles, can travel this fast, but hypersonic vehicles are far more maneuverable and unpredictable, making them harder to intercept. Unlike reusable spacecraft, the thermal protection systems used on U.S. hypersonic missiles — which solely deliver conventional weapons — are designed for a single use.

"This project came about because I was talking with Jon Murray one day, and he told me he needed to predict the response of heat shields more rapidly to assist his Department of Defense customers," said Justin Wagner, an aerospace engineer and the project's lead researcher. "He (Jon, a Sandia aerospace engineer) said 'Can we find a way to use the science tools that are being developed here and combine that with our systems integration know-how?' Ultimately, the project is focused on trying to understand what will happen in flight more quickly. It will limit how many materials we need to qualify and help us understand them better."

The project tested materials ranging from common graphite — the same carbon used in No. 2 pencils — to more exotic carbon-based and ceramic composites. Hundreds of samples were made by the materials science team led by Sandia researcher Bernadette Hernandez-Sanchez, with contributions from Oak Ridge National Laboratory.

Laboratory tests on the ground

The intense shock of reentry comes from distinctive aerodynamics that include high temperature, intense pressure and vibration. These conditions are impossible to replicate completely on the ground, but researchers can create experiments that mimic portions, Justin said.

For example, the team used an inductively coupled plasma torch to study the chemical and physical changes in small samples of heat-shield materials as they burn up, or ablate. They recently shared their results in the American Institute of Aeronautics and Astronautics Journal. For this experiment, the researchers scorched materials with plasma hotter than the surface of the sun. This work was primarily done at the University of Texas at Austin, Justin said.

To test larger slabs of potential heat shields, the team turned to Sandia's National Solar Thermal Test Facility, which uses sunlight concentrated by a field of mirrors to generate extreme temperatures. The team also used a hypersonic shock tunnel to mimic the aerodynamics of flying at Mach 10. The tunnel can produce both extremely high temperatures and Mach-velocity gas bursts, but only for a fraction of a second.

The researchers compared the results to advanced ablation models developed by collaborators at the University of Minnesota Twin Cities. Additional materials science data came from collaborators at the University of Colorado Boulder, University of Illinois Urbana–Champaign and Kratos Inc., Justin said.

Building better, faster models

The modeling team, led by chemical engineer Scott Roberts, used data from the lab experiments to develop a computer model of the heat-shield material properties, aerodynamics and heat-transfer physics of a hypersonic vehicle in flight.

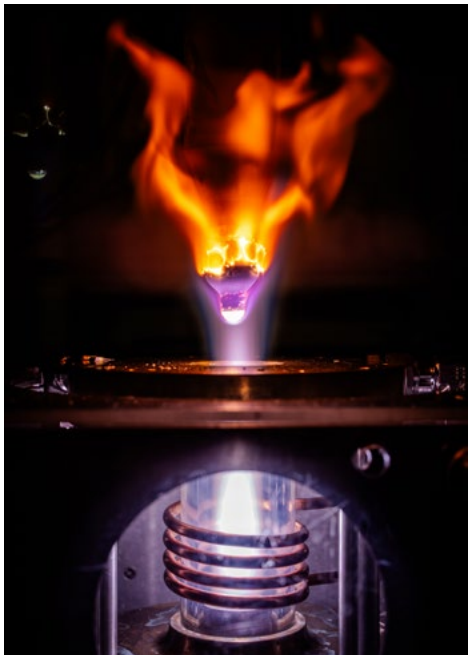
Then a team led by aerospace engineer Jon Murray took the results of the full-physics model to train a reduced-order model.

If the full-physics model is a bitmap version of an image — a file that contains data for each pixel — the reduced-order model is like a JPEG, which still shows the important features while compressing the less important areas, Jon explained. The big challenge was determining the best method to identify the most important features and the equations that best describe their behavior, he added.

Jon's team trained the reduced-order model on several sets of results from the full-physics model, using machine learning to identify the important features, he said. The resulting model was 90% accurate compared to the full-physics model for missions and vehicle designs similar to those trained upon, Justin added.

The reduced-order model can simulate the response of a heat-shield material thousands of times faster. While the full-physics model can take days to produce results on a supercomputer, the reduced-order model produces results in seconds on a desktop computer, Jon said. This allows researchers to rapidly design vehicles for new missions or assess whether an existing design would work for a new mission.

"What we're trying to do is make it seamless to go from the full-physics model to this reduced-order model so that any time they make a change in the



FLAMIN' GOOD TIME — Sandia's inductively coupled plasma torch is very similar to the University of Texas at Austin's torch used to test heat-shield materials for this project. Data from the lab tests was used to refine a computer model to more rapidly evaluate materials for hypersonic vehicles. **Photo by Craig Fritz**

ROASTING, TOASTING

Watch a video of Sandia engineers testing a heat-shield material in an inductively coupled plasma torch. The plasma can reach temperatures hotter than the surface of the sun, replicating the intense heat of hypersonic flight.

Video by Craig Fritz

properties of the heat-shield material in the full model, we can incorporate that in a more or less automated retraining of the reduced-order model," Jon said.

Validating via flight tests

To demonstrate the credibility of both models, the team flew samples of the heat-shield materials on rockets.

"Flight tests are really important because they provide the actual environment you're trying to qualify these materials for," said mechanical engineer Katya Casper, who coordinated the flight testing. "While we do our best to replicate pieces of flight on the ground, we can't replicate everything at the same time. Flight gets you everything."

So far, the team has flown samples on two suborbital rocket launches through the Multi-Service Advanced Capability Hypersonics Test Bed program. These rockets host experiments from 10 to 20 research teams per mission, as each launch is expensive, she added.

For the test flights, the team used samples ranging from the size of a quarter to 4-inch-long wedges. Both sizes were outfitted with temperature sensors to track how hot the materials got during flight.

The flight test team also included sensors to study chemical changes that occurred during flight to validate the results from ground-based experiments. The first flight included an optical emission spectrometer, and the second flight included a laser absorption spectroscopy system developed in partnership with Purdue University and PSE Technology, Katya said.

Next, the team will test a new tile built with multiple material samples and temperature sensors on the nose of a reentry capsule scheduled to launch in summer 2026. This will be an Air Force Research Laboratory-sponsored test flight through the Prometheus program.

"This flight is exciting because if all goes well, we'll get the tile with the samples back," Katya said. "We'll get to see what it looks like and characterize the materials afterwards." This includes measuring how much material ablated away and studying the chemistry of the remaining material to add even more credibility to the models.

The project was funded by Sandia's Laboratory Directed Research and Development program.

Three labs, one model

CONTINUED FROM PAGE 1

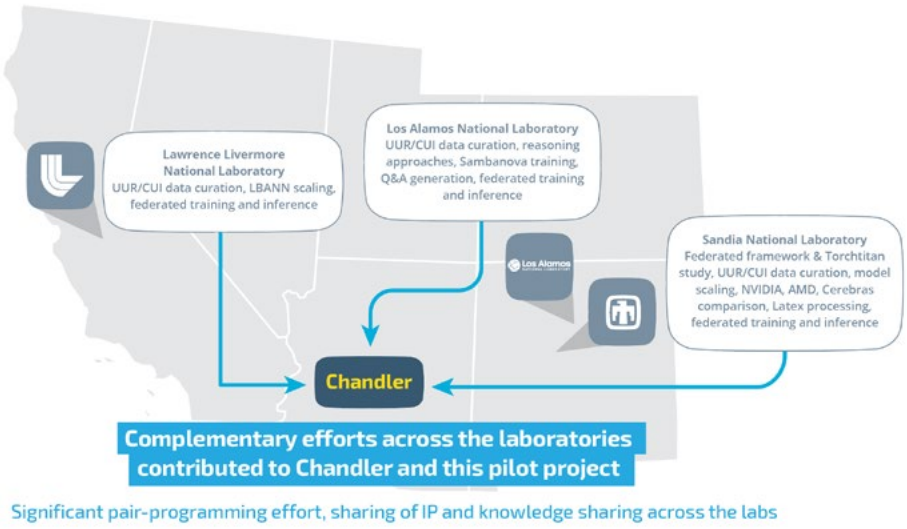
learning is a technique for training AI models on decentralized data.

Led by Sandia and funded through the NNSA's Advanced Simulation and Computing program, the project started with a high-risk but high-reward goal of training a large, federated AI model across the trilabs.

"In order to make AI tools more accurate and more applicable to our national security mission, NNSA is going to need an enduring capability to train, and consistently retrain, AI models with our classified datasets," said Si Hammond, program director of advanced computing in the NNSA Office of Advanced Simulation and Computing. "Federated training is a critical tool to delivering a robust capability in a cost effective, performant and secure way."

Building AI models while safeguarding sensitive data

Each of the trilabs possesses unique datasets that are not easily shareable, yet they hold valuable insights for collaboration in critical mission areas. "Commercial large language models often fall short in their response to NNSA mission-relevant queries," said Siva Rajamanickam, distinguished member of Sandia's technical staff and the project's lead. "Due to the inaccessibility of this specialized data within NNSA laboratories, the effectiveness of open-source or proprietary models is limited for our use cases."



BRIDGING DISTANCES — The model is named Chandler, after a city in Arizona and a symbolic center point between all three laboratories. The name channels the spirit that though the data may come from three laboratories miles apart, there is a central meeting place in this model where collaboration and innovation can happen. **Data provided by Siva Rajamanickam; graphic by Ray Johnson**

Despite the challenges of training a language model on three different, geographically distributed systems, the research team has successfully demonstrated a prototype that proves a shared model is possible while protecting each laboratory's unique data. Through the federated-learning approach, the trilabs have proven that they can collaboratively train the model by sharing only the "weights," or the parameters that represent the model's learning, without explicitly exchanging the datasets themselves.

The project used NVIDIA's NVFlare, an open-source federated-learning software, to orchestrate the training process. At each phase, or epoch, of the training process, the software exchanges the updated weights, but not the data, between the three labs to allow them to be averaged together to form

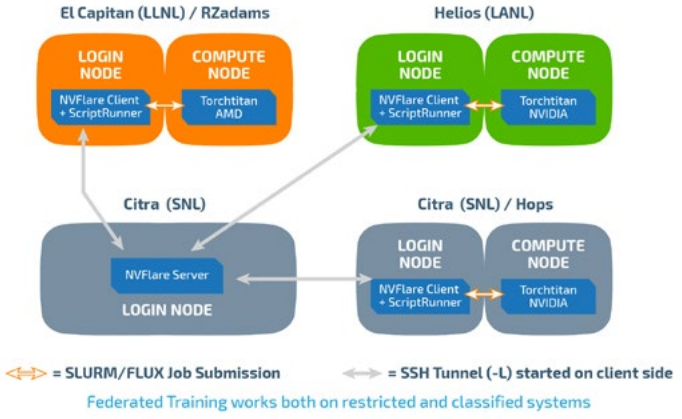
a single model. This updated set of weights is then sent to the other labs for the next epoch of training to begin.

"The labs coordinated on the processing of data to ensure that (it) was available in the format that the local training software, Meta's open-source Torchtitan library, could handle," said Chris Siefert, principal member of the technical staff at Sandia. "Sandia and Lawrence Livermore researchers demonstrated that Torchtitan can scale well on both NVIDIA and AMD GPU hardware, including results on Livermore's El Capitan, the world's fastest supercomputer."

Early collaboration enables future success

A memorandum of understanding among the ASC executives at the three laboratories enabled the sharing of model weights. Jen Gaudioso, director of the ASC program at Sandia, said, "By putting our data management and weight-transfer protocols into a single memorandum of understanding, Sandia, LANL and LLNL laid the foundation for an agile federated-learning ecosystem that will drive next-generation mission outcomes."

Sandia has a strong team in AI research. Interest in this project was a natural extension of efforts like the BANYAN Institute for Generative AI, which unites AI initiatives across the labs by sharing datasets, models, software stacks, expertise and industry collaborations.



COLLABORATION IN FEDERATED TRAINING — Once the data had been processed, researchers at all three labs opened the SSH tunnels for communication and started the client and server processes. The NVFlare software was used for the training, and the final model was then tested by researchers for output quality. **Data provided by Siva Rajamanickam; graphic by Ray Johnson**

This federated-learning project is just the beginning. Research will continue into how the model can be improved and expanded while ensuring that it will not memorize or replicate the shared data but still understand it.

Pump up your strengths with Deb

By **Magdalena Krajewski**

Deb Menke is the ultimate hype person.

"I just really try to be there to pump people up," said Deb, a community relations specialist at Sandia.

You don't have to talk to her long to realize she that she is absolutely the kind of person you'd want in your corner. So, it tracks that Deb teaches a course at Sandia focused on discovering and celebrating individual strengths.

CliftonStrengths

Deb discovered CliftonStrengths more than 20 years ago. Originally called StrengthsFinder, this Gallup-developed personal assessment tool helps people identify their different strengths and talents across 34 themes. The methodology is based on the idea that people and teams achieve greater success by focusing on their strengths rather than trying to improve their weaknesses, building the collaboration and teamwork necessary for Sandia mission success.

STRENGTHS FINDER — Deb Menke teaches a class using the CliftonStrengths Assessment at Sandia. **Photo by Craig Fritz**

Deb's husband had taken the assessment with his leadership team at work, and when he came home and shared his insights, Deb was immediately intrigued.

"I read the book, 'Now Discover Your Strengths,' which accompanies the assessment, and it was fascinating," she said. "I've always loved learning about myself and what makes other people tick."

At the time, Deb was working in Employee Health Services at Sandia. After finishing the book, she approached her manager and asked, "Can we do this?"

The answer was yes.

"My group did it, then my center, and soon all the program coordinators we worked with participated too," Deb said. "I started leading the course at Sandia, and it evolved into a word-of-mouth phenomenon, with different organizations reaching out to conduct the assessment with their teams."

Lifting others up

While Deb has been teaching CliftonStrengths for nearly two decades, she has been uplifting others since childhood. "I've always been passionate about this," she said. "As a kid, I played every kind of sport and was part of many teams including swim team, basketball, volleyball, softball, summer tennis and cheerleading. Once I got to high school, I had to narrow down my interests, but I was almost always team captain because I loved to energize the group, motivate my team and help my teammates tap into their strengths."

In her friend group, Deb played a similar role. "I was the one they called when they needed a pep talk, reminding folks that whatever it was, they could do it and that they were awesome," she said.

Career journey

In college, Deb considered becoming a teacher or a nurse — something where she could help people. Ultimately majoring in community health at the University of Wisconsin while working part-time jobs lifeguarding, teaching aerobics, swimming lessons, and coaching middle and high school volleyball and basketball.

In 1995, Deb moved to Albuquerque and joined Sandia through a field experience for college credit, then student intern in Employee Health Services and went on to pursue a master's degree in health promotion. She has been with the Labs ever since, working in various roles, including team lead, manager, medical case management, drug testing program administration, preventive health professional, executive health coach and now community relations specialist, where she manages the K-12 STEM outreach program that allows her to engage employees and career exploration opportunities for students.

MAXIMIZER — Deb Menke teaches the CliftonStrengths Assessment to a class on Oct. 9. Deb first learned of CliftonStrengths more than 20 years ago and has been sharing her passion for the program ever since. **Photo by Craig Fritz**

A common theme throughout Deb's career has been her drive to understand others, "speak the same language as engineers and other Sandians," as she puts it, to better serve her customers. "Years ago, I signed up to be mentored by a director because I wanted to know what it was like to be a technical director," she said. "I'm always trying to learn more — not just about the work we do, but about the people who do it."

Deb's impact

Sandia has offered CliftonStrengths at the request of teams since 2008, reaching 100 teams across the labs. Last year, the course was made available to all employees through Organizational Development and Talent Management, reaching nearly 150 people. She also teaches the course to high school students attending Sandia's Quantum, Computing, Mathematics, and Physics Summer Camp (QCaMP) and New Mexico's Consortium Summer Physics Camp.

"I think it can be hard for people to talk about themselves, especially their strengths," she said. "This is true for both students and Sandians. People can be shy or may not fully understand or feel comfortable articulating their strengths, but this program helps them see how working in their top strengths allows them to find their stride and be their best."

Deb has witnessed numerous ways CliftonStrengths has impacted Sandians, from inspiring career shifts to improving team collaboration and understanding. "Sometimes people realize their current job isn't aligned with their strengths, and this course gives them the push they need to make a change," Deb said. "Other times, it helps teams align around individual strengths to produce better results. But what I love most is how it helps people understand each other while better understanding themselves."

Coach, captain, motivator, champion — Deb is working in her top strengths when she is helping others find theirs, and we are all better for it.

Talent Development at Sandia

There are several assessment-based workshops offered through Sandia's Talent Development office. Staff can find more information for teams and individuals by visiting Talent Development's website or reaching out to HR Solutions. Manager approval is required to enroll.

One surprise positive from the pandemic makes a return at Sandia

By **Lance Perry and Johann "Yo" Snyder**

Five years ago, during the pandemic, slips, trips and falls at Sandia reached an all-time low; not a surprise because most of the workforce was working from home. What is a surprise is that five years later, with much of the workforce back on-site, those numbers have reached a similar low. In November 2025, there were a total of two slip, trip, and fall incidents — the lowest on record since the pandemic and the most recent low-point of an encouraging trend.

About 85% of walking injuries are linked to poor decisions. Many employees choose to stray from designated paths, opting instead to traverse rock beds, cut corners or walk in areas where the risk of injury is considerably higher. These decisions can lead to a range of injuries, from minor bruises and scrapes to more severe cases involving broken bones and damaged teeth.

In response, Sandia's Director and Chief of Safety David Stuhan greenlit the "Stay On. Stay Well." Walking is Working program in early 2025. This campaign to encourage the workforce to stay on the beaten path is making positive strides.

In the six months leading up to the program's launch, Sandia averaged 9.5 walking injuries per month. However, in the six months following the initiation of the program, incidents dropped to an average of 6.33 injuries per month, resulting in a 35% reduction in walking injuries. This achievement is a testament to the diligence and active participation of employees in prioritizing safety while walking on campus.

Of course, the ultimate goal is zero walking injuries, which can only be accomplished one step at a time through the continued practice of safe walking habits. This includes adhering to dedicated walkways, avoiding distracted walking, using crosswalks when crossing streets and steering clear of areas and debris that elevate the risks of slips, trips and falls.

For questions regarding the "Stay On. Stay Well." Walking is Working program or to schedule a presentation on walking injuries during an upcoming team meeting, staff can reach out to Lance Perry.

STEP BY STEP — The average person walks 4,000 to 18,000 steps per day. Over a year, that totals 1 million to 4.5 million steps each year at work per employee. This equates to trillions of steps, "near misses," for Sandians. **Photo by Craig Fritz**

STAY, DON'T STRAY — The "Stay On. Stay Well." sign. **Photo by Lance Perry**

HELPFUL REMINDERS — Cards have been handed out to 3,000 employees, so far. **Photo by Lance Perry**

Serial innovator takes top award in 'Oscars of Innovation'

By **Michael Ellis Langley**

In a remarkable recognition of his research and development leadership contributions to scientific and innovative technologies, Hongyou Fan has been named the **R&D 100 Researcher of the Year for 2025**.

This prestigious award, often referred to as the "Oscars of Innovation," highlights the most significant advancements in research and development across various industries. The selection committee evaluates winners on their previous awards and recognitions, volunteer work, mentorship and other outreach participation.

Hongyou's work in material science, chemical science, and nanoscience and technologies for sustainable energy solutions has positioned him as a leader in his field.

"Winning this award is not just a personal honor; it reflects the hard work and dedication of my entire team from multiple areas across Sandia," said Hongyou, who has dedicated more than 25 years to Sandia. "Our mission has always been to address national priorities through innovative research, and this recognition validates our efforts."

His journey at Sandia began as a postdoctoral researcher in 1997 after completing his doctorate at the University of New Mexico.

"I was very fortunate to stay at Sandia," Hongyou said. "I received offers from various companies and national labs, but looking back, I believe I made the right choice."

His commitment to Sandia has led to significant advancements in science, energy and materials sustainability. In 2019, the **New Mexico Legislature honored Hongyou** as a serial innovator.

In 2022, Hongyou was recognized by the Society of Asian Scientists and Engineers with their **Career Achievement Award**, which celebrates outstanding contributions to science and engineering. This accolade further solidified his reputation as an R&D leader in his field. In 2025, Hongyou was selected as a Fellow by the **National Academy of Inventors**.

Hongyou's current role as a manager for the Geomechanics and Geochemistry Department involves overseeing critical programs that align with national priorities. He has played a pivotal role in establishing Sandia's critical minerals program, which focuses on advancing science and technologies for recovering essential resources like lithium and rare earth elements.

"The goal is to build a domestic supply chain for critical minerals using our natural resources," Hongyou said. "By 2035, DOE aims to have 50% of our critical mineral supplies sourced domestically."

The R&D 100 award is particularly significant as it highlights the impact of Hongyou's work on both national and global scales.

"Our research is not just about understanding the science of materials; it's about applying that knowledge to solve real-world problems," he said. "For instance, our work on lithium recovery from brine sources is crucial for the development of batteries and renewable energy technologies."

Hongyou's dedication to scientific advancement is evident in his collaborative efforts with various teams at Sandia. He has led projects that explore the molecular and nanoparticle behavior of materials under extreme conditions, which has contributed to breakthroughs in material science and has been **recognized with the Materials Research Society Medal**. The **Materials Research Society** is a group of professionals that promotes communication for the advancement of interdisciplinary materials research and technology to improve the quality of life. Hongyou was recently elected to the board of directors where he will take on another leadership role for the broader scientific community.

IN THE SPOTLIGHT — Hongyou Fan hits the red carpet at the R&D 100 Awards in November before accepting his honor for Researcher of the Year. **Photo courtesy of Hongyou Fan**

"We study how nanoparticles interact under pressure, which can lead to the discovery of new materials with unique properties," he said. "This research is essential for creating more efficient energy storage solutions."

The recognition from R&D 100 is a testament to the importance of Hongyou's work in the context of national security and energy independence. As the U.S. seeks to reduce its reliance on foreign sources of critical minerals, the program he leads provides a pathway to harness domestic resources sustainably.

In addition to his research accomplishments and leadership, Hongyou is also committed to mentoring the next generation of scientists. He encourages young researchers to pursue their passions and remain patient in their endeavors.

"Science is a long journey, and it's essential to stay focused and persistent," he advised. "Many breakthroughs take years of dedication, and it's important to believe in the work you are doing."

Hongyou's recognition as the R&D 100 Researcher of the Year is not only a personal achievement but also a reflection of Sandia's commitment to innovation and excellence in research. His leadership and vision have inspired many within the laboratory and beyond.

"I am proud to be part of a team that is making a difference in the world," he said. "Together, we are addressing some of the most pressing challenges facing our society today."

Hongyou accepted his award at the R&D 100 ceremony on Nov. 20, saying that he remains focused on the future.

"This award motivates me to continue pushing the boundaries of what is possible in our field," he said. "I look forward to the challenges ahead and the opportunity to contribute to a sustainable future for our planet."

Inaugural town hall for Nuclear Deterrence and Science executive directorate

By **Kristen Meub**

The leadership team for the newly formed Nuclear Deterrence and Science executive directorate held an inaugural town hall on Nov. 13 at Steve Schiff Auditorium to review its structure and answer employee questions. Deputy Laboratories Director Rita Gonzales was joined onstage by Associate Laboratories Directors Doug Kothe, Brad Boswell and Steve Girrens.

Doug discussed each of the centers in the Advanced Science and Technology division and shared the team's enthusiasm and excitement to be part of the new directorate.

Brad described the three key missions shared by the centers in the Nuclear Deterrence Modernization and Stockpile Systems division. He explained the importance of quality data and data collection for stockpile work, the fast pace of modernization efforts and how the team's technical assurance work and all its underpinnings are the glue that pulls everything together.

Steve shared high-level accomplishments for the Nuclear Deterrence Components and Production division and described the team as a highly focused design agency for components — in some cases producing components at Sandia and sometimes partnering with the Kansas City National Security Campus and others, with work focused on neutron generators, explosives and other nonnuclear components.

During the Q&A, the leadership panel answered questions from employees related to how the directorate will collaborate within Sandia and with other labs.

"Simplify, empower and partner — those are going to stay stable as priorities for the future," Rita said. "Artificial intelligence and advanced capabilities for future systems are likely to be new technical imperatives that will be added to the strategy. We are a directorate that continues to deliver and innovate, and I think our strategy has to be part of everything we do to accelerate our work."

Throughout the town hall, the team emphasized their gratitude for employees and the work they do. "Any challenge that has come to this lab, we have stepped up and knocked it out of the park," Rita said. "It is all based on you, your will, your dedication, your ability to think outside the box when needed, your ability to accelerate when needed. There's no challenge we can't take on, especially when we do it together as a team."

NEW DIRECTORATE — The executive leadership team for the Nuclear Deterrence and Science executive directorate discussed the new structure and strategic priorities. **Photo by Craig Fritz**

TAKING QUESTIONS — Most of the town hall was dedicated to answering employee questions on a variety of topics, including leadership priorities and collaboration within Sandia and with other labs. **Photo by Craig Fritz**

Electric car challenge buzzes with AI

FINAL LAP — Students from Piñon Elementary School in Santa Fe, Wylone Timbal, left, and Kamryn Bachina celebrate their advancement to the finals of the New Mexico Electric Car Challenge. The event was sponsored by Sandia and Los Alamos national laboratories and hosted at Kennedy Middle School in Albuquerque on Nov. 15. **Photo by Craig Fritz**

ZOOM ZOOM — Students from Jefferson Middle School in Albuquerque, Pablo Sandoval, right, and Tomas Giron let their car loose under the watchful eye of Sandia volunteer Justin Tea during the New Mexico Electric Car Challenge on Nov. 15. In addition to racing their cars, students compared the energy consumption of electric vehicles and AI models, such as ChatGPT, and the data centers that support them. **Photo by Craig Fritz**

POWER AND DESIGN — The Republic of Pickle team from Chamisa Middle School in Los Alamos presents their cars to judges during the design presentation portion of the New Mexico Electric Car Challenge. **Photo by Craig Fritz**

Recent Patents

July-September 2025

Note: Patents listed here include the names of active Sandians only; former Sandians and non-Sandia inventors are not included.

Following the listing for each patent is a patent number, searchable at the U.S. Patent and Trademark Office website.

- **Andrea Ambrosini and Eric Nicholas Coker:** Redox-active oxide materials for thermal energy storage. Patent #10800665
- **Leo Joseph Small and Melissa Lynn Wygant:** Mediated metal-sulfur flow battery for grid-scale energy storage. Patent #12272850
- **Jesse John Bland, Stephen M. Carr, Patrick Sean Finnegan, Juan Pedro Mendez Granado and Michael C. Hamel:** Meissner-effect transition-edge-sensor microcalorimeter. Patent #12352634
- **Matthew W. Moorman and Joshua Jonathan Whiting:** Monolithic multi-dimensional chromatography. Patent #12352732
- **Erik J. Skogen:** Continuously variable optical confinement for optical amplifiers. Patent #12355209
- **Todd Charles Monson:** Isostatic pressure spark plasma sintering (IP-SPS) net shaping of components using nanostructured materials. Patent #12358050
- **Joshua Paquette and Thomas Maddox Rice:** Systems and methods for remote, automated non-destructive inspection. Patent #12360082
- **Katherine Anne Barrick, Todd Andrew Barrick, Lorenzo Jiron, Thomas John Rogers, Eric A. Shaner, Zachary Medaris Wilson and Edward G. Winrow:** Reusable filtering face mask. Patent #12364883
- **Javier Hernandez Alvidrez and Matthew J. Reno:** Dynamic mode decomposition systems and methods to detect power quality events. Patent #12366598
- **Elliot James Fuller and Albert Alec Talin:** Programming analog memory elements in a neumorphic computing system. Patent #12366881
- **John Michael Gladden:** Use of ensiled biomass for increased efficiency of the pretreatment of biomass. Patent #12371855
- **Ross Guttromson:** Wind turbine management system for controlled energy storage. Patent #12372057
- **Clifford Ho and Jeremy Niko Iversen Sment:** Systems and methods for high temperature bulk solid storage and handling. Patent #12379135
- **Brian Douglas Homeijer, Paul J. Resnick and Ryan Austin Shaffer:** Large mass MEMS resonant beam accelerometer. Patent #12379391
- **Hongyou Fan:** Synthesis of ordered nanorod arrays. Patent #12384966
- **Weng Wah Chow, Jongmin Lee, Adrian Samuel Orozco and Jonathan David Sterk:** Measurement protocol for large dynamic range and high sensitivity of an evanescent-field-mode guided atom interferometer. Patent #12392611
- **Thomas Farley Babuska, Nathaniel S. Bobbitt, Michael E. Chandross, John Francis Curry, Steven Robert Larson, Ping Lu and Alexander James Mings:** Environmentally stable solid lubricant coating. Patent #12404474
- **Florentino Barrientos, Adrian R. Chavez, Sung Nam Choi, John C. Pavlakos, Alan Sonntag and Neil Sparks:** Systems and methods for automatically updating system firmware. Patent #12405781
- **Adam Cook and Bryan James Kaehr:** Optical measurement system for real-time process monitoring of aerosol jet printing. Patent #12409650
- **Paul Davids, Christoper Todd DeRose, Michael Gehl and Christopher Michael Long:** System and method of optical scanning with detection of return signals using a star coupler. Patent #12411215
- **Roger Derek West:** Modular multi-angle synthetic aperture radar sensor on a track. Patent #12416721
- **Daniel Dominguez, Andrew Jay Leenheer and Nils Thomas Otterstrom:** Ultraviolet and visible light integrated acousto-optic modulators. Patent #12416824
- **Eric D. Bloomquist, Molly Brown, Mario Jon Cortez and Nathan A. Davey:** High voltage discharge units and methods for discharging high voltages. Patent #12418189
- **Jeffery A. Greathouse, Matthew J. Paul and Guangping Xu:** Separation of krypton gas from xenon gas using natural clinoptilolite. Patent #12421115
- **Brooke Nicole Harmon, Yooli Kim Light, Catherine Margaret Mageeney and Jennifer Schwedler:** Lung-targeting nanobodies and purification methods. Patent #12421306
- **Vitalie Stavila and Matthew David Witman:** Hydrogen compression and storage systems. Patent #12422099
- **Amber Lynn Dagel, Patrick Sean Finnegan, Ryan Nicolas Goodner, Andrew Eugene Hollowell, Johnathan Mulcahy-Stanislawczyk and Roger Derek West:** Speckle-based imaging diffuser and method for controllably fabricating same. Patent #12424346
- **Jongmin Lee, Hayden James Evans McGuinness and Peter Schwindt:** Compact atom interferometry inertial navigation sensors with tailored diffractive optics. Patent #12424810
- **Nils Thomas Otterstrom:** Integrated photonics with active polarization control. Patent #12429716

Mileposts

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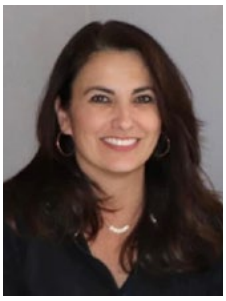

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