SANDIA LABNEWS
PUBLISHED SINCE 1949

Vol. 76, No. 19, Oct. 3, 2024

From small-town NM to Sandia CFO **Page 9**

Deflecting doom: How Sandia research could save Earth from asteroids

A BETTER WAY — The asteroid Dimorphos, pictured here, was nudged by NASA in a deflection test in 2022. Sandia scientists have developed a way to redirect an asteroid free-floating in space that may be more effective than previous methods. **Photo courtesy of NASA**

Free-floating experiments at Z machine provide deflection data

By **Neal Singer**

The most efficient way to prevent potentially dangerous asteroids from damaging or even obliterating Earth may involve a coordinated nuclear response based on extensive prior data, according to Sandia physicist Nathan Moore.

"To most people, the danger from asteroids seems remote," Nathan said. "But our planet is hit by BB-sized asteroids every day. We call them shooting stars. We don't want to wait for a large asteroid to show up and then scramble for the right method to deflect it."

His team created experiments at Sandia's Z machine, the most powerful pulsed-power machine on Earth, to monitor the deflection of synthetic asteroids subjected to Z's sudden shocks. These experiments also beat gravity temporarily to better simulate the reaction of asteroids floating freely in space.

— CONTINUED ON PAGE 4

Sandia-led collaboration achieves one of world's fastest molecular dynamics simulations

New method, eclipsing top supercomputer, is Gordon Bell prize finalist

By **Neal Singer and Shelby Owens**

In an era where supercomputers are setting the pace for scientific discovery, a collaborative team has not just broken but shattered a speed barrier in molecular dynamics simulations.

Their innovative simulation, powered by a novel wafer-scale engine, raced past the maximum speed achievable on the world's fastest supercomputer by an unprecedented 457 times, where speed is measured in simulation timesteps-per-second. This achievement, now a finalist for the esteemed Gordon Bell Prize, could herald a new dawn in molecular dynamics and computational science.

— CONTINUED ON PAGE 6

SANDIA GORDON BELL TEAM — From left, Aidan Thompson, James Laros, Sivasankaran Rajamanickam and Stan Moore, posing in front of Vanguard supercomputer, have been nominated for the Gordon Bell Prize. **Photo by Craig Fritz**

SANDIA LAB NEWS
PUBLISHED SINCE 1949
Managed by NTESS LLC for the National Nuclear Security Administration

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)

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

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

LAB NEWS ONLINE: sandia.gov/LabNews

TABLE of CONTENTS

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

Great Minds in STEM recognizes Sandia microgrid engineer

SHARING WONDER — Sandia electrical engineer Rachid Darbali-Zamora, right, shows the power of renewable energy and the microgrid to Alex Riebli and his children Mason, 7, and Addison, 4, during Family Day. Rachid has been honored with a Luminary Award by Great Minds in STEM for his technical achievements. **Photo by Craig Fritz**

Rachid Darbali-Zamora helps keep the lights on, wins Luminary Award

By **Mollie Rappe**

Rachid Darbali-Zamora's career has been defined by two pivotal moments: his introduction to renewable energy at a high school outreach event and his internship at Sandia.

Rachid, now an electrical engineer specializing in microgrids with renewable energy resources at Sandia, has been honored with a Luminary Award by Great Minds in STEM. The award recognizes professionals in science, technology, engineering and mathematics who lead, collaborate and initiate key programs and research in their fields, making significant contributions to the Hispanic technical community as leaders and role models. Rachid will receive his award at the 2024 Hispanic Engineer National Achievement Awards Conference in November.

"To me, this award is a call to action," Rachid said. "There is more that should be done to help support others in their careers, to make a difference. This is just the beginning of what I hope to accomplish."

Passion for providing "solutions for the little guy"

Rachid has always wanted to develop solutions to help others. However, it wasn't until he attended a STEM outreach event at his high school in Jayuya, a small mountainous town in Puerto Rico, and was introduced to renewable energy just how he could help people began to take shape.

He earned his bachelor's and master's degrees in electrical engineering from the University of Puerto Rico, Mayagüez, in 2013 and 2016, respectively. He participated in internship programs at Argonne and Pacific Northwest national laboratories, Ohio State University and Wright-Patterson Air Force Base.

In the summer of 2017, Rachid interned at Sandia through the Consortium for Integrating Energy Systems in Engineering and Science Education.

"The internship I did at Sandia showed me that here is where I could have the biggest impact," Rachid said. "I really wanted to work on projects that provided solutions for the little guy. It was a great experience. The internship helped guide what I wanted to do."

That fall, Hurricane Maria devastated Puerto Rico, causing thousands of deaths and months of power outages that affected more than 1.5 million people. This tragedy intensified Rachid's interest in renewable energy and resiliency. He was hired at Sandia shortly after receiving his doctorate in electrical engineering, energy systems, from University of Puerto Rico, Mayagüez, in December 2019.

"When I started, I really wanted to help come up with solutions to help communities in Puerto Rico, because those are the ones that I saw that were really affected by Hurricane María," Rachid said. "That's one of the big reasons why I joined Sandia."

LUMINARY LEADER — Sandia electrical engineer Rachid Darbali-Zamora has been honored with a Luminary Award by Great Minds in STEM for his technical achievements in microgrids with renewable energy resource management. **Photo by Lonnie Anderson**

Giving back through mentoring and outreach

Shortly after being hired at Sandia, Rachid began mentoring students in the successor internship program, similar to the one he participated in. Through the Consortium of Hybrid Resilient Energy Systems program, he has mentored six students and two visiting faculty members from University of Puerto Rico, Mayagüez. He has also mentored seven students through other Sandia internship institutes, five college students through capstone or business development courses, served as a thesis committee member for 10 students and mentored five new Sandia employees.

SPREADING PASSION — Sandia electrical engineer Rachid Darbali-Zamora volunteers at Garfield Middle School in Albuquerque, New Mexico, as part of Hispanic Outreach for Leadership Awareness's Noche de Ciencias. **Photo by Miguel Jimenez-Aparicio**

"I am very passionate about my job and research, but where I see the real impact is helping others achieve their goals," Rachid said. "You help a postdoc, you help an intern, or you help a graduate student, that is a very direct impact. It is very much time well spent."

Rachid is involved in Sandia's Hispanic Outreach for Leadership and Awareness employee resource group, particularly their STEM outreach event Noche de Ciencias. These bilingual family science events aim to get middle- and high-school minority students and their parents interested in STEM while highlighting the value of staying in school.

He also participates in other Sandia-led STEM outreach activities for students in middle school through high school, such as Meet a Scientist Day, Earth Day demonstrations and summer camps.

"There were a few outreach activities at my high school that got me really interested in engineering," Rachid said. "If you have a room full of 30 students and at least one of them is captivated by what you're showing and it motivates them, then that makes it worthwhile."

Developing microgrids for home and space

One of the research projects Rachid is most proud of is the Wind Hybrid Integration Platform, funded by the DOE Wind Energy Technologies Office. This project focuses on developing a management system for power systems and microgrids

with solar, wind and energy storage resources. The team tested the management system using Sandia's power hardware-in-the-loop platform with simulations mimicking power systems in Puerto Rico, Alaska and Texas.

"The WHIP project has given me a really good opportunity to do all of the things that drove me to Sandia, such as engaging and interacting with community members and working with partners at the University of Puerto Rico," Rachid said.

Rachid is also excited about a recently funded Office of Electricity project to design a microgrid controller that will use artificial intelligence to optimize the configuration of the microgrid and ensure equitable access to electricity, even with large amounts of variable renewable energy resources. He plans to work with communities in Puerto Rico, pueblos in New Mexico and Alaskan Native tribes as part of this project.

A microgrid links buildings and power sources, such as photovoltaics or diesel generators, to create small "islands" of power if the main electrical grid fails. These systems are often designed around critical infrastructure like hospitals and water treatment plants, enhancing community resilience against natural disasters.

In addition to these projects, he has also been involved in several Federal Emergency Management Agency-funded initiatives to explore possible locations for microgrids in Puerto Rico to improve post-hurricane resiliency and work with partners at University of Puerto Rico, Mayagüez,to provide training and workshops on Sandia's microgrid design tools to support local workforce development efforts.

Rachid's expertise in microgrids extends beyond Earth. He was part of a Sandia team that worked with NASA to design a DC microgrid for the future Artemis lunar base.

Rachid has published over 100 research papers and holds several patents. As an adjunct professor at University of Puerto Rico, Mayagüez, he supports students in their graduate studies.

"Helping other people grow is critical," Rachid said. "When you're starting in your career, you're probably the one being helped. As you advance, being able to help, mentor and provide support is vital. It's very easy to be distracted by proposals and papers, but it's really important to guide others in their journey."

Asteroids

CONTINUED FROM PAGE 1

The goal is to create tables detailing the reactions of asteroids of varying compositions to deflection attempts, which would provide valuable data to those responding to asteroid threats of the future.

Challenges and preparedness

"Practice makes perfect" is a reasonable philosophy, Nathan said, but there are too few large asteroids observable near Earth to gain expertise by experimentally deflecting them beforehand.

"The day after, there would be no re-dos."

In 2023, the National Academy of Sciences released a report calling planetary defense a national priority. An ongoing NASA sky survey deems the threats credible: There are an estimated 25,000 objects big enough to cause varying degrees of destruction that could approach Earth's vicinity, and only about one-third of them have been detected and tracked. Many move invisibly in the sun's glare. A relatively small arrival recently created chaos in Russia; a larger one is credited with ending the epoch of dinosaurs.

PLANETARY GUARD — Sandia physicist Nathan Moore stands with the Z machine facility, the source of his asteroid data, framed in the background. **Photo by Craig Fritz**

X-ray 'scissors' momentarily reduce gravity to zero

Responding to the need, Nathan and a team of Sandia scientists developed a method to record how much change in direction, or momentum, would be imparted to mock-asteroid material when subjected to the powerful pulses of Sandia's Z machine. The experiment uses a technique called X-ray scissors, which removes the skewing effect of friction and gravity for a few microseconds. This helps model the actual circumstance of redirecting an asteroid free-floating in space when impacted by a series of nuclear-intensity explosions.

That is, the force of the explosion on the mock asteroid could be scaled to predict the effects of nuclear explosions on an actual asteroid.

"I started working through the logic of how I could deflect a miniature asteroid in a laboratory just like in outer space," Nathan said. "A key fact was that asteroids in outer space aren't attached to anything. But in a lab, everything is pulled down by Earth's gravity, so everything is held in place by its gravitational attachment to something else. This wouldn't let our mock asteroid move with the freedom of one in outer space. And mechanical attachments would create friction that would perturb the mock asteroid's motion."

The solution was to release the mock asteroid into the free space of vacuum, leading to the X-ray scissors concept.

To simulate a possible code red, Nathan's team placed a tenth of a gram of asteroid-like material — in this case, silica — in the target chamber of the Z machine, which reaches the temperature of the sun. The material was suspended by very fine foil, eight times thinner than a human hair, that instantly vaporized when Z fired. The process, termed "X-ray scissors," untethered the sample material and left it free-floating, unaffected by gravity, just as the machine's X-ray burst struck it. The velocity and impact of the target mass were noted. Researchers believe they can model the change in velocity exerted by a nuclear explosion near an asteroid free-floating in space.

Future steps and implications

"It was a novel idea," Nathan said. "A mock asteroid is suspended in space. For a one-nanometer fall, we can ignore Earth's gravity for 20 millionths of a second as Z produces a burst of X-rays that sweeps over the mock-asteroid surface 12.5 millimeters across, about the width of a finger.

"The trick is to use just enough force to redirect the flying rock without splitting it into several equally deadly subsections advancing toward Earth," Nathan said, referring to a real intercept scenario like the recent NASA DART experiment.

The experiments, reported in the Sept. 25 issue of Nature Physics, are the first steps to creating a library of induced changes in asteroidal velocity to be consulted when an actual asteroid is analyzed by laser to determine its contents and its mass and velocity are telescopically known.

"Some asteroids are believed to be held together loosely — so-called 'rubble piles' — and how that would respond in the explosion will require more complicated mathematics. But without this capability, we would have to rely on practice missions in space, which are few and costly," Nathan said.

NASA has only done one such mission to date, he said, and it involved a different deflection mechanism — kinetic impact — that wouldn't be suitable for the most Earth-threatening asteroids.

The team also has questions about fundamental properties of asteroid material under these extreme conditions — how the relationships between a material's density, pressure and temperature change during asteroid deflection, which is also relevant to planetary formation, planetary impacts and even the robustness of walls for future fusion reactors.

Innovating the X-ray scissors technique

Physicist Nathan Moore took over the asteroid project from his colleague Seth Root, an early pioneer of asteroid deflection research. Nathan soon became aware that existing measurement approaches wouldn't accurately capture all the momentum.

"We needed something better," Nathan said. He developed the X-ray scissors concept to improve the accuracy of their asteroid interception results.

With little time before the scheduled shot at the Z machine, Nathan spent hours scribbling on his whiteboard and inputting rough numbers into spreadsheets. Confident in his idea, he asked his colleague Jason Sanchez to run computer simulations, which confirmed his predictions. Within days, Nathan began collaborating with mechanical engineer Carlos Aragon to turn the concept into a constructible design. Additional simulations helped fine-tune the design, and they completed it within a few weeks. Parts were ordered and arrived just days before the shot.

On the day of the shot, Nathan was in Spain celebrating his 15th anniversary with his wife, a trip planned the previous year. His colleague Chad McCoy supervised the shot-day activities and then sent Nathan a single text, brief in the grand tradition of science announcements: "It worked!"

Gordon Bell

CONTINUED FROM PAGE 1

The prize, sponsored annually by the Association for Computing Machinery, recognizes outstanding achievement in high-performance computing. The winner will be announced at SC24, the premier conference for supercomputing, in November in Atlanta.

Researchers from Sandia, Lawrence Livermore and Los Alamos National Laboratories — referred to as the tri-labs — worked together with Cerebras Systems as part of NNSA's Advanced Memory Technology program. The simulation was performed on Cerebras' wafer-scale engine technology.

The new paper, "**Breaking the Molecular Dynamics Timescale Barrier Using a Wafer-Scale System,**" describes the coordinated effort that connected Cerebras' ground-breaking capabilities to the molecular dynamics simulations already under development at the three NNSA laboratories.

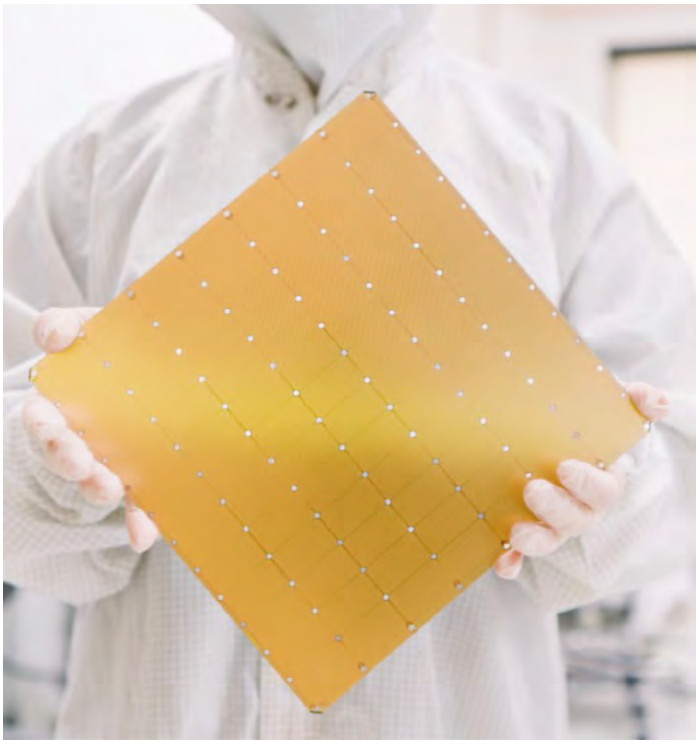
"The ultra-rapid simulation speed provides views for milliseconds instead of nanoseconds, offering a more complete picture of how materials evolve and behave," said Sandia researcher Siva Rajamanickam, who led the tri-labs' collaboration with Cerebras. "The ability to perform calculations this rapidly on a general-purpose processor enables the science community to understand chemical processes and material behaviors at timescales previously unachievable in commercially available hardware."

Potential applications include more detailed studies of the evolution of grain boundaries in metals to create more resilient materials, enabling renewable energy researchers in designing extended-duration energy storage systems and, with further enhancements, the observation of protein folding and drug-target interactions to accelerate the discovery of life-saving therapies.

An innovative approach

This new computing approach achieves its speed by distributing the simulated atoms to the 900,000 cores on a single Cerebras wafer-scale engine. Interactions between the simulated atoms result in communication between the cores on the wafer, rather than many graphics processing units as done on Oak Ridge National Laboratory's Frontier, the world's fastest supercomputer.

Sandia molecular dynamics expert and paper author Stan Moore put it this way: "Latencies in current supercomputers — such as the time it takes to send a message across the network — limit the timescales that can be achieved. On the Cerebras system, these latencies are greatly reduced, allowing orders of magnitude speedup in achievable timescales."



COMPUTING PARTNERS — A worker at Cerebras Systems holds the world's largest computer wafer, to be used as part of the collaboration between Cerebras and three national labs. The partnership will accelerate future advanced simulation and computing applications in support of the national nuclear stockpile.

Photo courtesy of Cerebras Systems

Aidan Thompson, a Sandia co-author of the paper and an expert in molecular dynamics who helped guide Cerebras on the algorithmic details of this project, praised the sheer speed of Cerebras technology.

"The maximum speed of a simulation had remained stubbornly fixed for at least the last decade at around 5 kilosteps per second," Aidan said. "The Cerebras wafer-scale engine has smashed this barrier by achieving a speed of 699 kilosteps per second. Only highly specialized codes on specialized hardware run faster, and that advantage may not last long."

"This bodes well for the future impacts of our program and its potential scientific advances," said James Laros, a distinguished member of technical staff at Sandia and lead of the Advanced Memory Technologies program. "The Advanced Memory Technology-based partnership between the NNSA laboratories and Cerebras Systems reached new heights when the speedup on molecular dynamics simulations exceeded the AMT program's goal — a 40-times performance improvement — by more than 10 times."

"We all had our doubts about achieving this goal within the short timeframe, but Cerebras' technology and new methods from our team helped us exceed this goal by demonstrating unprecedented improvement on molecular dynamics simulations," Siva said. "These results open opportunities for materials research and science discoveries beyond what we envisioned."

Innovative architecture enabled the team to surpass the performance level previously achieved. "The tri-labs have been fantastic partners in our journey. It is wonderful to see scientists at the laboratories actively collaborating with our team and pushing our wafer-scale technology to new frontiers," said Michael James, Cerebras co-founder and chief architect of advanced technologies. "The success in molecular dynamics simulations is hopefully one of many to follow. We are very excited to continue the partnership with NNSA."

Thuc Hoang, director of NNSA's Advanced Simulation and Computing program, reflects on the strong partnership between the labs, NNSA and Cerebras.

"The collaboration between Cerebras, Sandia and the tri-lab community illustrates the advantage of industry partnership with the NNSA in the innovative AI technology space," Hoang said. "It is a great example of the breakthroughs in science that can be achieved together, that would otherwise not be possible by any party on their own. We look forward to seeing continued partnerships with Cerebras and others for both AI and our scientific modeling and simulation missions."

A sense of perspective

Stan Moore compares the graphics processing units on Frontier to racehorses: There are thousands of them, and paradoxically, that creates difficulties for relatively small problems.

"Imagine a simulation where you are trying to pull a cart," Stan explained. "If you hook up one horse, it can move the cart, but it is slow. If you hook up eight horses, it goes faster because they can share the weight, but ultimately a horse can only run so fast even if it is pulling little weight. If you hook up 500 horses to the same cart, they just get in each other's way, so adding too many horses to one cart doesn't help. In contrast, the Cerebras wafer is like a race car that can pull the cart so much faster."

Many scientific calculations, while benefiting from the increased speed of Frontier, are small enough that they will benefit even more from Cerebras, Stan said.

Exceeding expectations

"Accomplishing such a result not only takes vision, but some sort of insane confidence in your ideas," Siva said. "We thought it was a measured risk based on our experience and knowledge, but not everyone would think so. When we proposed it to our lab leadership and NNSA. They trusted us to run with it. That's because we have an environment where we can take measured risks to solve these big problems that others will shy away from."

Both James and Siva attribute the Advanced Memory Technology program's role in taking measured risks as part of the investigatory process as an outcome of the Vanguard program, also led by James through the Advanced Simulation and Computing program. While Advanced Memory Technology works towards proof of concept in a technology space, Vanguard focuses on deploying advanced at-scale prototypes.

Vanguard addresses the gap between successful laboratory experiments and large-scale production by industry, filling that void with imaginative, mid-scale prototype platforms that reduce the odds of anything technically infeasible lurking on the road to full scale. Because it requires relatively small funding, a wider range of experimentation and risk is encouraged. If any fail, that's provisionally good, because something imaginative was probably tried.

Work such as that exemplified in the Gordon Bell submission could help drive a next generation of prototype systems under existing DOE programs, such as Vanguard.

The work is funded by NNSA's Advanced Simulation and Computing program. The NNSA is a semiautonomous DOE agency responsible for the management and security of the nation's nuclear weapons, nuclear nonproliferation and naval reactor programs, as well as responding to nuclear and radiological emergencies in the U.S. and abroad.

A culture tolerating risk makes a big difference

While researcher Siva Rajamanickam praises Cerebras, he also emphasizes the hard work and calculated risks taken by Sandia researchers that made the project possible.

"The AMT program and this team responded when Congress asked, 'Can you get us 40 times better performance for far less money?'"

The Congressional request, based on emerging possibilities, was to build a program capable of demonstrating significant speedup over the world's leading exascale supercomputer.

"We accepted the challenge. In two years, we beat Frontier — using a single Cerebras wafer — by 457 times. We took measured risks, knowing it is OK to fail," Siva said. "We were supported by both NNSA and lab leadership. That culture makes a big difference."

Even the selection of Cerebras, clearly the right choice in hindsight, was carefully vetted.

"Cerebras has been making their hardware for artificial intelligence applications," Siva said. "We wanted to use it for scientific computing. This is new to them, new to us, and the first time anyone has done anything like this — that we know of — in the world. We worked on demonstrating the approach together for two years, codesigning where computer scientists and material scientists came together to design a new algorithm. Sandia, Cerebras, LLNL and LANL all came together to develop the method, choose the right problem to solve and execute it perfectly."

Celebrating Hispanic heritage

Photos by **Craig Fritz**

LOWRIDER LEGEND — James Michael Romero takes a close look at David Zamora's 1964 Cadillac Coupe de Ville during the Hispanic Heritage Month celebration at Hardin Field on Sept. 12. The car won the People's Choice award at the car show.

CULTURE IN MOTION — Dancers with Tierra Adentro Baile Flamenco perform at Hardin Field during Hispanic Heritage Month celebrations.

Humble beginnings, big career

How a small-town Hispanic girl became CFO

By **Kim Vallez Quintana**

Delfinia Salazar's story begins like that of many Hispanic New Mexicans. She was born into a large family in a rural town, surrounded by extended family where religion played a significant role. She was raised in a humble home with parents who sometimes struggled to make ends meet and taught to work hard because nothing in life comes easy.

But each new chapter Delfinia writes in her story is proving anything but typical. This small-town New Mexico girl, who was often told a Hispanic woman couldn't go to college, has achieved what she never even saw in her future: becoming the chief financial officer at Sandia.

Delfinia, known as Del to most, is the second Hispanic woman to hold this position. This alone is an admirable achievement, but Del's story makes this accomplishment even more remarkable.

OUTNUMBERED BY THE BOYS — Del, bottom left, in a family photo from 1980 with her parents David and Marcella Tapia, and four brothers David Leon, Carl, Kenneth and Lonnie.

Photo courtesy of Del Salazar

Growing up in New Mexico

"I was told that girls like me shouldn't aspire to do more than raise a family," Del said. But Del was determined to carve her own path. "If I was told I couldn't do something, I naturally told myself I was going to do it."

It's something Del had to remind herself of many times throughout her life.

From a young age, Del had a love for reading. She learned at 3 years old. Living 45 minutes from Santa Fe in Chupadero, a tiny town that she says isn't technically considered a town, Del always looked forward to the Bookmobile's visits. "When I was little, I couldn't wait for it to come so I could get a grocery sack full of books."

It was the beginning of what she calls "her love of constant learning." No one in her family had graduated from college, but Del never doubted that she would. Taking college courses while still in high school, Del had a plan for her future.

Life's challenges

Then life, as it sometimes does, had other plans. In Del's case, it brought what she calls an "unexpected blessing." She became pregnant at 17 years old. "Nothing I can't handle," Del told herself. She and her now-husband Gregory still had big plans.

Then, just 28 weeks into her pregnancy, Del gave birth to their son Jesse. He weighed 2 pounds, 8 ounces. He was rushed to the Neonatal Intensive Care Unit at the University of New Mexico Hospital. Del had to stay behind, as Jesse's father went with him.

AN UNIMAGINABLE FUTURE — Del Salazar, chief financial officer and director of finance, keeps her family photo and accounting license nearby in her Sandia office.

Photo by Craig Fritz

"That was the most challenging night of his life, watching what was happening to our son," she said. "They let my husband hold our son that night, telling him he likely wouldn't survive. When I was able to get there the next day, it was a life-changing moment for me — for who I needed to be as a person, as a mom, as a partner."

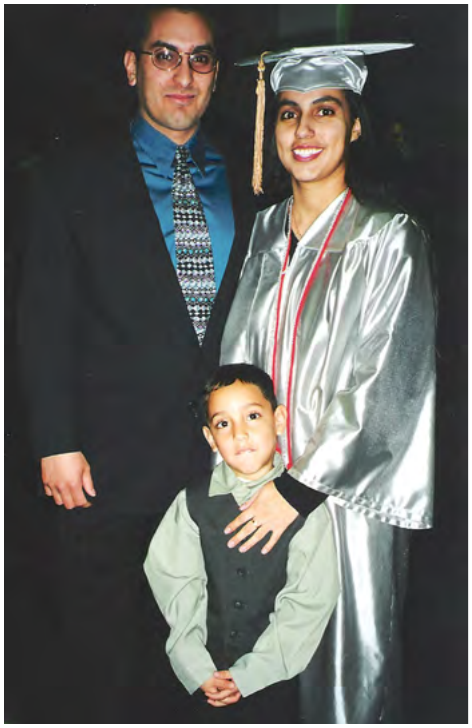
It wasn't easy. "We sacrificed a lot. We had to quit our jobs in Santa Fe. I failed a semester of classes. We didn't know where we were going to stay each night or where our meals would come from, but we had to be there for our son," Del said.

She leaned on her family and her faith.

"Being a mother flipped a switch in me. I

WORKING HARD AS A FAMILY — In a photo from the 1980s, Del and three of her brothers make adobe bricks to build the family home in Chupadero, New Mexico.

Photo courtesy of Del Salazar



WALKING PROUD — Del poses with her husband Greg and son Jesse after graduating with a bachelor's degree from the University of New Mexico in 2001. **Photo courtesy of Del Salazar**

told myself, 'he will make it. We are going to make it through this,'" Del said. "I just would not let myself believe he was not going to get better."

Molding her future

Del's optimism paid off. Her son did get better, but it took time. Through it all, Del continued to work toward her future. She earned her high school diploma and continued her studies in community college. Del's passion was reading and numbers, leading her to pursue finance and accounting.

However, Del's experience was far from traditional. She didn't walk the stage on graduation day, live as a student on a college campus or go out with friends. "I was focused on being a mother and reaching the next milestone that I knew I had to achieve. Obtaining those degrees and securing the best job I could get to support my family were my priorities. I had to ensure I had a good career going forward."

Del went on to earn an associate degree, a bachelor's degree with a dual major and three master's degrees. By her side the whole time were her husband and son, sometimes literally.

"I sometimes had to take my son to class with me," Del said. "We would go to the duck pond and then to class, especially when I worked at UNM and taught classes in grad school. He would sit and take notes. He was just a little guy learning to read at the time."

Del reflects on it as another blessing. Little did she know at the time, she was molding his future too.

"He lived through it with us. He saw our dedication, working multiple jobs while taking classes. It was amazing to hear him say, 'After I go to college, I'm going to Disneyland,' or 'After I go to college, will you have cookies for me?' There was never a doubt that college was his next step, even when he was so little," Del said.

Finding a place at Sandia

Del's hard work eventually earned her a spot at Sandia. She started as an intern in 2003. Seven months later, she was hired full time and slowly began climbing the ladder. Del has served in many roles during her more than 20 years at Sandia but it's her latest role as CFO that she considers her "unimaginable future."

She credits part of her success to her mentor Bonnie Apodaca, the first Hispanic woman to hold the CFO title at Sandia.

"She brought me into her office one day to talk about my aspirations, which at the time didn't include CFO. She then asked me, 'Why aren't you aspiring to sit in my chair?' It was eye-opening. I realized I was putting limitations on myself because I was a female and minority. That day changed my momentum at the Labs."

Del began as CFO in April 2024. While it is a significant accomplishment, Del said "pride" isn't necessarily the word she would use to describe it.

"I feel gratitude more than anything," she said. "Gratitude for those who have supported me. I am grateful for the intelligence, sense of humor and work ethic passed on to me from my parents. I am grateful for my husband and our son for cheering me on. I am grateful for the opportunities afforded to me at Sandia. I am grateful for the amazing career that I've had and being able to explore and contribute in different ways to our important mission."

A PROUD SON — Del's son Jesse proudly poses with his mom's cap and gown and bachelor's degree, earned in 2001 from the University of New Mexico. **Photo courtesy of Del Salazar**

How far she's come

Del's role as CFO is a world apart from serving continental breakfasts and doing housekeeping at a local hotel, where she held her first job at 14 years old. Around this time, Del experienced an incident at a store in Santa Fe that had a lasting impact on her. She remembers going to the store to buy an outfit for a high school internship with her hard-earned money in hand.

Del's living legacy

Del Salazar said one of her greatest accomplishments isn't just her career but helping her son Jesse find his. He followed in his mother's footsteps, earning a master's degree in 2019 and becoming a certified public accountant in 2023.

INSPIRING THE NEXT GENERATION — Del and her husband Greg celebrate their son Jesse's master's degree in 2019. **Photo courtesy of Del Salazar**

"I will never forget it. They wouldn't serve me. They kept going to people around me. Finally, a woman spoke up and asked 'Why aren't you allowing her to buy this?' The clerk said, 'She's either going to steal it or doesn't have the money.' It was an assumption that because I was Hispanic, I was unable to pay."

That wasn't the only time Del experienced a negative stereotype because of her ethnicity.

"In school, my mom had to fight for us, for the teachers to place us in honors classes," she said. "There was an assumption that because we were Hispanic, we were not intelligent."

A champion for diversity

Del is helping break those stereotypes, not only through her own example but also as part of Sandia's Hispanic Outreach for Leadership and Awareness group and the Belonging, Equity, Diversity and Inclusion initiative.

"As a Hispanic woman, I am grateful that we value diversity here," Del said. "My husband and son are Native American, so I am passionate about being a strong advocate. I want to help people see that they belong here and that they can bring their full selves to work and learn about each other's cultures and individual character."

Del has always felt a sense of belonging at Sandia. "I have felt like I have a home, and my contributions are valued."

Del wants others to feel the same. When asked what she would tell young Hispanic girls or others still searching for their future, she said, "The present moment used to be the unimaginable future. Don't accept limitations. Imagine where you might be, what you can pursue in life. There is excitement, adventure and innovation in how we get there. If you don't dream, you may not realize what you can accomplish."

DOE awards funding to two early career scientists at Sandia

By **Sophia Horowitz**

Sandia scientists Mitchell Wood and Gianluca Geraci recently received 2024 DOE Office of Science Early Career Research Program awards. They will each receive $2.75 million over five years to support their research in the Office of Science program areas of Fusion Energy Sciences and Advanced Scientific Computing Research. A total of 91 awardees from universities and national labs were chosen through peer review by scientific experts from a large pool of applicants.

Mitch Wood

Computer scientist Mitch Wood works in the computational multiscale department. His research spans multiple disciplines, ranging from developing tools and methods to application-driven projects. Currently, his research spans plasma-facing materials, multiscale modeling of shock compression and physics-inspired machine learning.

"I am exhilarated by work that leverages my background in physics, materials engineering and computational methods to forge new perspective on challenging, impactful problems," Mitch said.

With the award funding, Mitch plans to conduct a multiyear, in-depth study on how materials withstand radiation damage and to develop new methods that contribute to the design of fusion power plants. His proposal is titled "Mechanisms of Non-Equilibrium Ion Dynamics in Radiation Tolerant Alloys."

"At the core of my research is the idea that new data-science methods can capture physical processes that have historically been too computationally expensive to apply to materials for fusion energy. However, there is no free lunch," Mitch said. "The challenge is that you must train these methods on expensive predictions to extend them to the problems I am interested in. Therefore, the first phase of my work will focus on defining the accuracy-cost tradeoffs between the underlying theory and the proposed methods."

Gianluca Geraci

Computational scientist Gianluca Geraci works in the optimization and uncertainty quantification department. His current research focuses on uncertainty quantification, multifidelity methods, data-driven approaches and related fields such as dimension reduction and optimization under uncertainty. Uncertainty quantification is a multidisciplinary field at the intersection of applied mathematics, statistics, computer science and physics.

COMPUTATIONAL EFFICIENCY — Mitch Wood, a computer scientist in the computational multiscale department, received a DOE Early Career Research Award for his research on materials science and machine learning.

Photo courtesy of Mitch Wood

"At DOE and Sandia, we handle high-stakes applications every day. It's essential to characterize and quantify the uncertainties in

QUANTIFYING UNCERTAINTY — Gianluca Geraci, a computational scientist in the optimization and uncertainty quantification department, accepted the DOE Office of Science Early Career Research Award, which honors his research in scientific machine learning for predictive computational science.
Photo courtesy of Gianluca Geraci

our numerical models to build confidence in our scientific predictions, designs and safety and reliability assessments, which often rely on computational models rather than physical experiments. Without a robust uncertainty quantification methodology, we cannot call our computational science 'predictive,'" said Gianluca, who has applied uncertainty quantification to various problems, including internal and external aerodynamics, wind energy, radiation transport and computer networks.

Gianluca's awarded project, titled "Enabling Scientific Data-Driven Modeling for Heterogeneous, Multi-Model, Massive, and Distributed Datasets," aims to advance the development, deployment and analysis of mathematical and algorithmic tools within the field of scientific machine learning. These tools will enable the next generation of scientific discoveries for applications at DOE, which differ from traditional machine learning applications due to their data sparsity.

"I am humbled and grateful to DOE and Office of Science for their confidence in my work and proposed scientific endeavor," he said. "This award will support my research for the next five years and allow me to build a small team to help develop and realize my scientific vision. My overarching goal is to advance the state of the art of predictive data-driven computational methods using concepts that leverage my uncertainty quantification background. This is how I envision my contribution to the scientific mission of our nation, the Department of Energy and Sandia."

Support on the path to success

Amanda Barry, manager of the Sandia Office of Science program, emphasized the significance of the Early Career Research Program awards in nurturing emerging scientific talent.

"The DOE Early Career Research Program awards provide researchers with the resources and support they need to pursue innovative and impactful research, driving advancements in fields critical to our nation's energy and security," Amanda said.

The Early Career Research Program provides support for exceptional researchers at universities and DOE national laboratories to advance their research careers and expand scientific discovery in areas supported by the DOE Office of Science. These areas include Advanced Scientific Computing Research, Biological and Environmental Research, Basic Energy Sciences, Fusion Energy Sciences, High Energy Physics, Isotope R&D and Production, and Nuclear Physics.

Sandia pineapple enthusiast wins Guinness World Record

By **Maggie Krajewski**

When Rich Ellenson was growing up in New Jersey, he decided he wanted to organize a neighborhood basketball pickup game. So, he did what any 12-year-old kid would do and convinced his neighbors to let him borrow their portable basketball hoops so he could drag them down the street several times a week and play full court.

Years later, after attending the University of Maryland, Rich was looking for a friendly ultimate frisbee game and when he couldn't find one, he took it upon himself to organize one.

Fast forward to present day, Rich, an information and communications manager with Sandia and self-proclaimed pineapple enthusiast, has set his sights on a new mission: breaking the Guinness World Record for peeling and slicing a pineapple.

Rich said that while he's not outwardly competitive, when he gets into something, he really goes for it.

RECORD BREAKER — Rich Ellenson is the new Guinness World Record holder with the fastest time for peeling and slicing a pineapple.
.
Photo by Spencer Toy

"When I decide I want to do or learn something, I drive it to success," Rich said. "I've done this in my career and in my life. I'll pick something up and learn it until I'm essentially a master at it, or master enough to do the job."

Now, back to the pineapple.

Why pineapple?

In 2023, Rich was winding down a stressful and all-consuming home renovation project, adding a second story to his home where he lives with his wife and two children.

"The renovation was all I thought about for months," Rich said. "It kept me up at night and was overall a pretty difficult time."

But finally, it was wrapping up and Rich's brain started to think about what was next.

"I've always loved pineapple," Rich said. "I will eat an entire thing in one sitting, but I wondered if there was a better way to cut it."

Rich said he started watching videos on YouTube to see how others peeled and cut the prickly fruit, then started looking up the fastest methods and from there he stumbled across the Guinness World Record. At that time it was held by Oscar Lynagh of Australia, who in 2022 won the record for cutting and peeling a pineapple in 27.02 seconds.

"I started cutting pineapple really fast and decided that I wanted to break that record," Rich said.

Practice makes perfect

Rich explained that the process for entering the Guinness World Records is a lengthy one.

"First you email them to find out what it takes, then there's 30 pages of rules and requirements to read through," Rich said. "There are lots of rules about cutting pineapple: there's a minimum pineapple weight, you have to cut it a certain way, the skin cut off can only be so thick, the pieces you cut can't be bigger than an inch and a half on all sides, the knife you use must be commercially available. And then there's the evidence portion. You need witnesses who they can contact, you need a food service professional in attendance, two timekeepers with stopwatches, photos, videos, and this all has to be done in a publicly accessible space."

Once it was a go, Rich spent months cutting and eating pineapple in his garage, his kitchen, anywhere he could. In what he calls his clean practice runs, he was cutting the fruit in about 21-22 seconds, which he felt good about as it gave him some slippage time.

Next, Rich needed to organize a day and time to break some records. Finding a one-hour window of time that worked for the various witnesses, the food service professional and his timekeepers, was the biggest challenge, he said. Finally, he had a date — Saturday, April 13, 2024.

Leading up to the event, he scouted local supermarkets for the perfect pineapple that met the weight requirements and, as only a pineapple cutting expert would know, was the ideal firmness. He found the best ones at his local fruit markets and Whole Foods.

"A firmer pineapple gives your knife something to really push on and cut through. If it's too squishy the knife won't make a straight cut and if you don't get a straight cut, you could accidentally cut too much of the pineapple meat with the skin, which could invalidate your results," Rich said.

Rich's big day

The days leading up to that Saturday were bright and sunny, Rich said, but April 13 was the first rainy day that northern California had seen in two weeks. But if rain means good luck on a wedding day, why not on a Guinness World Record making day?

"The day arrived, and it was almost like an out-of-body experience," Rich said. "There were around 30 people gathered outside on my street. They all represented these different facets of my life. I had my family, friends, neighbors, coworkers, my kids' teachers even. I had been practicing for so long by myself, and suddenly there are all these people there to watch me to do this thing."

Rich had purchased 12 pineapples that morning, not thinking he'd need all 12, but turns out he did.

"My heart was beating so fast at first, I could have jumped over an 8-foot fence," Rich said. "I made some awful cuts in those first two or three pineapples, I didn't even have the food service professional look over them. I got to the fifth or sixth pineapple and, while I had calmed down, the pieces I cut were too large, so those got rejected. I start to get in a better rhythm and on my eighth pineapple, I make a clean cut, a perfect run, clocking in at 17.85, four seconds faster than my previous best time."

By the end, Rich said his hands, protected by a metal cutting glove, were cold, wet and sticky. But just like he did with his childhood basketball game and his post-college-era ultimate frisbee team, he set his mind to something and made it happen.

Record breaking

Shortly after the event, Rich submitted all the necessary information to Guinness World Records: a cover letter, graphs, photos and videos.

"They said it takes a maximum of 16 weeks from when you submit the information to when you find out if you're the record holder or not," Rich said when he was interviewed for Lab News in early September.

It had been 18 weeks at that time, but Rich was optimistic, which, from his hour-plus interview, seems like a core part of his character — determined and optimistic.

When I first heard about Rich and his record-breaking attempts, I, like you perhaps, asked myself, "A record for what?" but now I kind of get it.

On Sept. 30, 24 weeks and two days after that 17.85 second perfect run and four days before this story was published, Rich got word that he was officially the **new Guinness World Record holder** with the fastest time for peeling and slicing a pineapple.

"It feels nice to be the best at something, even if it's a strange something," Rich said. "One of these days, my kids or someone's kids can ask their Amazon Alexa who holds the record for peeling and cutting a pineapple the fastest, and the answer will be me."

Then and now: Tonopah Test Range control tower

CROW'S NEST — The control tower at Tonopah Test Range in Nevada offers a commanding 360-degree view of the remote desert range. In the black-and-white photo from 1982, former test director Palmer Nelson observes a launch. Today, the space has been modernized with 37 monitoring screens and cutting-edge technology, but the testing continues under watch of current test director Joe Simile.

Left photo from the Lab News archives; Right photo by Craig Fritz

Excellence through generations

Sandians reflect on decades of Family Day

By **Krystal Romero-Martinez**

Sandia has benefited from 75 years of a diverse workforce and their families, whose support has been important part of Sandians delivering exceptional service in the national interest. Family Day, one of Sandia's oldest traditions, is an opportunity for staff to invite families and friends on-site to tour their workplaces and deepen their understanding of the impactful work they do.

FAMILY TRADITIONS — Shavawn Bell-Jenkins and her mom, Gina Bell, at Family Day in the '90s.

Photo courtesy of Shavawn Bell-Jenkins

The first Family Day was held in Albuquerque on Feb. 14, 1959, and in California on April 18, 1959. Since then, these events have become celebrations that offer a variety of activities for all ages. This year's Family Day honors the Labs' 75th anniversary and is an opportunity to reflect on Sandia's rich history.

In an interview with retired engineer Larry Moya, he reflected on attending Family Day as a child. His father Manuel Moya started at the Labs in 1947, when it was Z Division of Los Alamos National Laboratory. Larry recalled visiting the machine shop on Family Day, a memory that sparked his interest in working at Sandia. Larry's son Steve, now an engineer and manager, toured the Labs on Family Day in the '90s and remembered learning about the computer-aided design systems and feeling the cool air in the server rooms during his visits.

Rates analyst Scott Newberry, inspired by his grandfather's 36 years at Sandia, joined the Labs in 2016. A few years later, He brought his wife and 5-year-old son to their first Family Day. They created memories that included roasting marshmallows at the solar tower and donning firefighting gear from Emergency Operations.

The Bell family: Generations of excellence

For Shavawn Bell-Jenkins, a research and development science and engineering manager, the road to Sandia began during her first experience at Family Day.

Shavawn's mother Gina Bell started at Sandia as a division secretary in 1980, when she met Carmen Ward, who would later become Shavawn's godmother.

"I remember thinking, 'My mom works here, so I want to work here too!'" she said.

In 1996, Bell retired from her role as a computer analyst programmer, but she still enjoys returning on Family Day with Shavawn to see what has remained the same and what has changed.

Shavawn's godmother later became Shavawn's first manager, hiring her in 2005 as a high school clerical intern. Reflecting on her early days, she remembers feeling intimidated by not knowing what she wanted to do. However, the mentorship and guidance she has received through the years helped immensely.

Now, Shavawn is determined to plant roots in her current area, managing the nuclear verification department in the Center for Global Security and Cooperation.

Family Day played a pivotal role in Shavawn's decision to pursue a career at Sandia, and she's excited that her daughter shares the same enthusiasm.

When she was young, Family Day offered Shavawn a glimpse into a world that can't always be shared, which influenced her future. Her hope is that Sandia's culture of mentorship and her own family's dedication to the mission continues.

"It's great to see that in my daughter. She doesn't know what she wants to do yet, but she knows she wants to work at Sandia," Shavawn said.

Family Day wrapped

The past, present and the future of Sandia can be mapped by families who work at the Labs. Although generational hiring hasn't happened intentionally, it has contributed to a strong culture at Sandia, blending old and new perspectives to drive future innovation.

This year, more than 15,000 people were registered for Sandia New Mexico's 14th Family Day and more than 2,200 in California. This was also the first time that remote sites such as those in Kauai, Hawaii; Carlsbad, New Mexico; Shoreview, Minnesota; Washington, D.C.; and Amarillo, Texas, have participated and hosted events for their employees.

Look out for more tales from Sandia families in future issues of Lab News.

HARD WORK PAYS OFF — Retirement plaque for Jose Romero to recognize 29 years of service at the Labs. **Photo courtesy of Michael Romero**

Over a century of service in the national interest

I've had many relatives who worked at Sandia, so I learned about its work environment at a young age. As a child, visiting Sandia during Family Day made the Labs real to me.

My grandfather, Jose Manuel Romero, was the first Sandian in our family. He started his career in 1957 and retired in 1986, dedicating over 29 years to the Labs supporting Facilities. My father Michael Orlando Romero followed in his footsteps and joined the Labs in 1979. He worked in various areas and contributed to many programs as a skilled machinist until he retired in 2019, after 40 years of service. Jerry Romero, my uncle, began his career at Sandia in 1985 as a custodian and worked his way up to records management before he retired in 2010.

"The legacy my dad started is great," my father said. "Between my dad, brother, myself and now my daughter, we have over 100 years at Sandia. All the different possibilities for development gave me the opportunity to provide for my family and then allowed my daughter to grow in her own career later. I hope the strong work ethic that my dad instilled in us continues to live on through future generations."

In 2015, when I began at Sandia as a clerical intern, my father and I carpooled to work together. As I reflect on that time, I realize just how special it was. I'm very proud to continue our family tradition at Sandia and am equally proud that the legacy has grown through my marriage into another generation of Sandians.

— Krystal Romero-Martinez

Mileposts

Tom Davis 40

Thomas Henderson 40

Tammie Towndrow 30

Karen Baca 20

Melissa Flury 20

Chris Olguin 20

Retirees

Michael Heroux 26

Gary Shoemaker 23

Science, food, fun at CA Family Day

Photos by **Spencer Toy**

GEAR UP — Young Family Day attendees at the California site got to imagine being a Pro Force officer, protecting the Livermore lab.

BEHIND THE SCENES — Some of the weapon systems developed at Sandia California were on display during Family Day on Sept. 21.

CYBER PET — Sandia California's robotics team hosted a popular Family Day attraction, moving around campus followed by a remotely controlled quadruped doing tricks for the crowds.

DARK KNIGHT VISITS LABS — Family Day attendees were all smiles as the Livermore site opened for tours, talks, good food and family fun.

VIRTUAL PLAY — The lines to experience Sandia California's virtual reality capabilities were moving all day, as attendees got to manipulate digital items in real space.