



S A N D I A

LAB NEWS

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BRACING FOR IMPACT — Sandia mechanical engineer Bo Song makes adjustments to the Drop-Hopkinson Bar, the only one of its kind in the world.

Photo by Bret Latter

Experimental Impact Mechanics Lab bars none

One-of-a-kind materials testing facility built from scratch

By **Luke Frank**

There's a tiny hidden gem at Sandia that tests the strength and evaluates the impact properties of any solid natural or manmade material on the planet.

From its humble beginnings as a small storage room, mechanical engineer Bo Song has built a singular Experimental Impact Mechanics Lab that packs a world-class punch in 200-plus square feet of

weights, rods, cables, bars, heaters, compressors and high-speed cameras.

Over the past eight years, Bo has overseen the growth of the lab's instrumentation, capabilities, staff and clientele, based on his work and ideas formed at other labs.

"We didn't start from the ground up, but close to it," Bo said. "I began with a small budget and limited tech support, but thankfully the lab was already

— CONTINUED ON PAGE 7

App assesses value of energy storage



A QUEST FOR MORE SUN — A new Sandia software application, called Quest, can help utility companies and corporate project developers assess how much money adding an energy storage system will save them. Energy storage systems capture energy from renewable sources, such as solar panels, and save it for later, when it is needed.

Photo by Randy Montoya

Energy storage critical for resilient grid, increased renewable energy

By **Mollie Rappe**

Utility companies and corporate project developers now have help assessing how much money adding an energy storage system will save them thanks to new Sandia software.

The software, called Quest, can also be used by energy researchers to evaluate different energy storage scenarios and model the potential of new solutions. Energy storage systems are important for capturing energy when it is produced and saving it for when it is needed.

Many renewable energy sources, such as

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ENGINEER OF YEAR

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Sandia deputy director to head national aeronautics institute

Laura McGill to replace Labs' deputy chief research officer as AIAA's president

By **Michael J. Baker**

Members of the **American Institute of Aeronautics and Astronautics** have elected Laura McGill, Sandia's deputy labs director and chief technology officer for nuclear deterrence, as the society's next president.

After an AIAA board of trustees meeting on May 19, Laura began a yearlong stint as president-elect of the institute that represents nearly 30,000 individual members from 91 countries and 100 corporate members to advance engineering and science in aviation, space and defense.



NEW LEADER — Laura McGill, Sandia's deputy labs director and chief technology officer for nuclear deterrence, has been elected the next president of the American Institute of Aeronautics and Astronautics.

Photo by Randy Montoya

“As an engineer with a lifelong excitement for everything related to aerospace, I am honored to serve in this role,” Laura said.

“For more than 40 years, I’ve benefitted from my AIAA membership and opportunities to work with the best minds of our industry,” she said. “I look forward to enhancing the personal and technical growth of our members, while helping to realize an even more promising future for this great institute.”


Laura will serve a two-year term as president. She will replace Sandia’s Deputy Chief Research Officer Basil Hassan as AIAA’s president.

“Laura and I have had a long working relationship of more than 25 years in AIAA,” Basil said. “Having her follow me will provide a lot of consistency. We have similar visions for the institute and the transition should be seamless.”

In 2007, Laura was elected a fellow of the institute and has been an active member for 40 years, leading and participating in several AIAA executive and technical committees. She was a member of the board of directors and trustees from 2005-2018.

Laura joined Sandia earlier this year after more than three decades in the

defense industry. Before joining Sandia, Laura served as deputy vice president of engineering at Raytheon Missiles & Defense, a Raytheon Technologies business with 30,000 employees, including 15,000 engineers and scientists. In 2019, she was inducted into the [National Academy of Engineering](#).

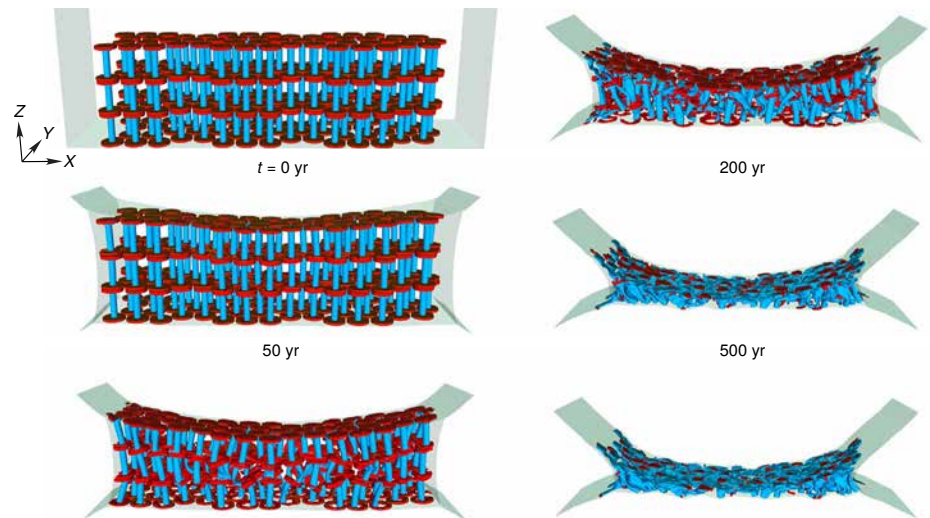
At Sandia, Laura leads the Labs in establishing modern engineering tools and practices for all nuclear deterrence programs and projects. She is responsible for meeting Sandia’s nuclear deterrence deliverables. 

New report chronicles Labs' high-performance computing achievements

By **Myles Copeland**,
Whitney Lacy and **Johann Snyder**

Sandia’s high-performance computing research has enhanced the understanding of exceedingly complex systems, from [atmospheric flight vehicles moving through the atmosphere at hypersonic speeds](#), to [the way waves behave 200 nautical miles off the East Coast](#), to [the burden that the spread of COVID-19 places on medical resources across the country](#). These efforts and more are chronicled in the Labs’ recently released [HPC Annual Report](#).

As detailed in the report, when COVID-19 threatened to overwhelm medical resources, Sandia high-performance computing provided critical predictive capability to inform decision-makers. It was used to model how patients with COVID-19 progressed through the hospital treatment system, as well as to predict the medical resources that would be needed to treat them, such as ICU beds, ventilators and medical personnel. The predictive work provided information essential to planning across more than 3,000 U.S. counties, including such crucial information as which hospitals would have enough of the right medical resources on hand to protect frontline workers and treat infected patients, and which states might have excess capacity to help others.




SALTY SIMULATION — Rock salt creeps under shear stress and slowly encapsulates the containers at the Waste Isolation Pilot Plant (WIPP) over hundreds of years. Simulations run on HPC machines predict the compaction of a certain type of container. Each container’s 55-gallon drum is hidden from view to reveal the fiberboard (red) and stainless steel flanged pipe (blue) within the container.

Image by Benjamin Reedlunn and James Bean

The report chronicles the Labs’ development of several new capabilities. For example, metamaterials are artificial optical structures that allow control of light in ways not offered by naturally occurring materials. They have many impressive potential applications and could even give solid material the appearance of air. Development of metamaterials has depended largely on trial and error, a problem addressed by Sandia’s R&D100 award-winning [Multiscale Inverse Rapid Group-theory for Engineered-metamaterials \(MIRaGE\)](#). An inverse

design software, MIRaGE allows the user to start with a desired optical outcome and end with an optimized metamaterial to achieve that outcome.

Sandia high-performance computing tools brought similarly striking predictive capability to [the way centuries of creeping rock salt will compress containers at the Waste Isolation Pilot Plant](#) and [how changes in design alter how much energy is lost or delivered to a target by an accelerator like the Z-Machine](#), while [enabling better understanding of Z-Machine data](#). 

Quest app

CONTINUED FROM PAGE 1

solar panels and wind turbines, don't produce electricity all day, every day. Energy storage systems, including lithium-ion-battery-based designs and pumped-storage hydropower, can increase the stability, reliability and resiliency of the power grid.

"We're providing an easy-to-use, open-source software suite that people can use to do their own energy storage analysis," said Babu Chalamala, the manager of Sandia's energy storage research program. "They could be small utilities or co-ops, vertically integrated utility companies or a project developer who wants to use energy storage. They can take this application suite and evaluate for the needs of their particular project. Does energy storage make sense? And, if so, what is the cost-benefit analysis? Quest can help with all those things."

"In our cutting-edge storage installations, we start by modeling the business case with Quest," said Imre Gyuk, who directs the Energy Storage Program at DOE's Office of Electricity. "If the results look promising to us and our project partners, we go ahead with the venture. After completion, we monitor the system using Quest for guidance and to optimize benefits."

Tools for electricity users, producers

The software suite currently has two principal tools: a behind-the-meter analysis tool for businesses or civil infrastructure, such as schools and hospitals, and a market-analysis tool to help utility companies assess how much revenue an energy storage system would generate.



BOTTOM LINE — Sandia's new energy storage software suite incorporates advanced mathematical models and optimization algorithms to help companies save money by investing in energy storage and reducing their electricity needs at peak times.

Video by Ruth Frank

With the behind-the-meter analysis tool, business owners or city project managers can estimate how much money an energy storage system will save them when combined with solar panels or other power generators, said Tu Nguyen, a Sandia electrical engineer who led the development of the optimization algorithms underpinning Quest.

First, the consumer inputs their location and the rate structure they pay. Frequently, electric utilities charge more per kilowatt-hour during certain times of the day when demand is high. By reducing their electricity usage during peak times, energy storage provides big savings for savvy customers on their electrical bills. The consumer can also input the kind of renewable power system they have or want to install, Tu said.

"For example, a homeowner or a warehouse manager who knows nothing about energy storage but wants to install it for their rooftop solar panels, can use Quest's streamlined process to learn how much money the energy storage system would save them over a year," said Tu.

The market-analysis tool looks at the other side of the equation. It was designed to inform small utility companies how much revenue an energy storage system would generate by providing services to enhance the grid stability and reliability. The tool has historical data for the seven energy markets in North America, including the Electric Reliability Council of Texas and the California Independent System Operator, each with different market conditions.

The Sandia team also provides support to help new users learn how to run the software in the form of webinars, tutorials and even developing new tools to answer different questions.

"Quest provides a very easy way to get at least a first estimate of the potential of the revenue, or cost savings, an energy storage system can generate," said Rodrigo Trevizan, an electrical engineer on the project. His goal is to add new tools and capabilities to make Quest more flexible and useful.

Expanding Quest to answer new questions

In partnership with PNM, New Mexico's largest electricity provider, the Quest team is working to develop software

tools to help vertically integrated utility companies assess the different paths for achieving reliable **100% carbon-free electricity by 2045**. A vertically integrated utility company both generates electricity and transmits and sells it to customers.

The Quest team just began investigating the costs and benefits of adding energy storage to the New Mexico grid in comparison with transmission-infrastructure expansion to better transport power from renewable energy power plants to cities, said Tu. Once the new tools have been developed and tested, they will be added to Quest for any utility company or energy researcher to use.

The Sandia team is also developing new tools to tackle different grid questions, said Tu and Ray Byrne, the manager overseeing the development of a suite of open-source software applications.

One tool will help with **resilient micro-grids**. A selection tool will help consumers compare different kinds of energy storage technologies depending on their locations and applications. They are also working on a cost-analysis tool and a tool for comparing different battery technologies as they age.

Long term, Sandia would like to include a distribution-modeling tool to quantify how energy storage can help increase the amount of solar power the grid can safely handle before the control systems need to be upgraded, Ray said.

Since Quest is open-source, other software developers are welcome to use the framework to develop new tools or applications to answer other energy storage questions, Tu said.

"Quest is a useful application suite for a lot of utilities, a kind of tool that isn't really available commercially," said Babu. "We are providing an application suite with the best foundational capabilities that can hopefully set the stage for further development in this area. If there are any other applications people need to develop, they can build off Quest to develop them."

The development of Quest was funded by the Energy Storage Program of Department of Energy's Office of Electricity. The Quest team is also partnering with **Quanta Technology** to support the development effort.

Largest aerospace society honors Sandia researcher as 'Engineer of Year'

'Jack-of-all-trades' improves future spacefaring calculations

by **Neal Singer**

Sandia researcher Humberto "Tito" Silva III has been named 'Engineer of the Year' by the world's largest aerospace technical society, the American Institute of Aeronautics and Astronautics.

Selected by a committee of his peers, Silva was honored for improving the prediction of failure rates for aerospace flight systems as they reenter Earth's atmosphere. The work helps engineers solve the worst problems first for reentry rockets, spaceships and satellites.

Tito's procedure, which he has dubbed "Tito's full-circle analysis methodology," uses computer modeling to determine the fewest number of computer simulations and physical experiments needed to get trusted data on a project.

"We were able to have high statistical confidence in our results. These were analogous to those achieved by researchers using many orders of magnitude more computational simulations and physical experiments," he said. "Our method saves money and time."

Former AIAA president Basil Hassan, who is also a Sandia director of science and engineering, said, "Tito's work helps ensure the safety, security and reliability of the nuclear deterrent by helping to understand potential uncertainties in extreme thermal environments. The methodologies developed here could also be used for other entry and reentry-type applications that similarly concern engineers."

Tito's award will be presented in August at the AIAA Aerospace Spotlight Awards Gala, an annual event the organization describes as "recognizing the most influential and inspiring individuals in aerospace."

Succeeding with failure

Tito credits his unusually varied background, which includes study in several engineering and science fields, for endowing him with a jack-of-all-trades outlook that connects with the deeper perspective of other researchers who self-confine to specific research areas.

"Many scientists deep-dive into subfields," he said. "My bread and butter is that I bring a different perspective. Technical experts fill in my knowledge gaps, and I fill in ones they haven't thought of." Tito describes himself as an "inside consultant" who can bridge subcategories in computer science, project management, and in aerospace, mechanical, chemical and electrical engineering.

He said acting as a catalyst in a variety of fields doesn't blur his research focus, which is thermal science, "pretty much the jell for all the work I've done."

His teams feed data from modeling and physical experiments — limited in number to keep costs down — into computer models expected to simulate the actual effects. Results from the models are then used in experiments to see how the derived data matches physically harvested data.

The work often shows considerable overlap between theory-based and experimental graphs, which lends weight to Tito's failure-rate predictions.

Super-sleuthing the cosmos

Working from an Earth-bound lab, Tito doesn't minimize the difficulty of determining events in outer space. The sleuth-like deductions are similar, he says, "to determining why an iPhone thermally or electrically fails in a box, if the box is in a closet, the closet in a room, the room in a building, the building on a barge in the hold of an aircraft carrier."

His first move is to simulate the environment, including the season of the year and time of day.



AT THE TOP — Sandia researcher Humberto "Tito" Silva III has been named 'Engineer of the Year' by the world's largest aerospace technical society, the American Institute of Aeronautics and Astronautics (AIAA). The society lists nearly 30,000 individual members from 91 countries and 100 corporate members.

Photo by **Lonnie Anderson**

Then, there's the equipment. "If the reentry body is made partly of stainless steel, we think we know its thermal conductivity. But there's material variability from different factories, so we have uncertainty in how that affects our vehicle. So, we use a range of possible figures," he said.

To solve questions about a particular system entering Earth's atmosphere, subspecialists were needed to find the sweet spot between different forms of heat transfer. "So, we did a computational experiment on how to use all the test equipment most frugally," Tito said. "We needed to determine the optimum amount of experiments and computer simulations, so we weren't running, say, 5 million computer simulations and 5,000 experiments."

Probabilities for all possible outcomes

Using these deliberately limited means, Tito's team found a way to map the probability space of all possible outcomes.

"Then we found a condition with our model that stressed the system," he said. "We used that in the computer domain and then again in the experimental domain in an iterative fashion. That gave us our result."

Said Darcie Farrow, a former system engineer overseeing nuclear weapons sustainment, "The multiple technical advances initiated by Tito are improving nuclear safety assessments as well as aerodynamic models for a wide range of flight systems."

Tito also has initiated collaborations with Los Alamos National Laboratory

resulting in nuclear weapon system models that capture the response of both labs' components in fire environments for the first time, she said.

Tito's family worked long hours in the medical field. He jokes he was the black sheep for going into engineering because he suspected it must have a better work-life balance. His children show strong aptitudes in music, a field that the guitar-playing Tito has retained as a sideline.

Belying the future complexity of his work, Tito grew up in farming country around El Paso, Texas.

There were no big buildings, and he could see for miles.

The open fields contributed to his interest in outer space. "It's easy to dream about the stars, growing up with only cotton fields in your backyard," he said.

But his life grew more complicated when he left astrophysics as he started graduate school.

"At the time, there was too much uncertainty in that field," he said. "You couldn't experimentally prove that there is such a thing as black hole — or, at least, back then there wasn't any experimental or tangible proof as there is now."

What got him back into studying space — specifically, aerospace engineering — to finish his graduate school education was the space shuttle Columbia disaster.

"I saw it in real time across the sky as I was driving my sister across Texas back to Baylor Medical center in early February 2003," he said.


The emotional impact of the sight was reinforced by Texas radio stations that repeatedly played Stevie Ray Vaughan's song "The

Sky is Crying," and it created a memory that he felt forged his future life path.

"I knew then," he said, "that I wanted to apply uncertainty quantification to safety-driven problems and that aerospace engineering was a perfect field for that application. It was like a homecoming for me, coming back to what I always loved."

The earlier space shuttle Challenger disaster was Tito's initial propellant into thoughts of aerospace. "The memory of watching that disaster — also in real time with my principal and my classmates while in school — left a huge impression on me as a young boy."

He maintains his interest in a number of academic fields in which he still takes classes and teaches "to this day," he said.

But in Tito's life, he said, "It's clear that aerospace tragedies have had their way with my destiny." 

Mileposts



Doug Bickel

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Eden Eager

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Deborah Jensen

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Tina Aiello

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Nicole Ballard

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Teresa Bennett

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Pat Cleland

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Catherine Green

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Janet Lovato

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Kyla Martinez

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Rich Schiek

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Mark W. Smith

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Daniel Villa

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John Linder

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Denis Ridzal

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Charles Smutz

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Sissy Whitechurch

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AIMING THE GUN — Bo Song, who developed the lab, places material for shock testing in the center of a Kolsky bar. When a gas gun is fired, the bar closes at the speed of a bullet train to assess how the material responds to stress and strain.

Photos by Bret Latter

Experimental Impact

CONTINUED FROM PAGE 1

conducting systems evaluation and technology development projects for Sandia and the National Nuclear Security Administration. With the assistance of a couple high-level technologists, we have built up the testing apparatus in that storage room.”

Bo says his groundbreaking work in experimental impact mechanics and evaluating the dynamic response of materials to temperature and pressure is quickly positioning the lab as a premiere facility in materials assessment for national security programs, defense contractors and private industry.

The lab also serves as a primary test facility for small-scale components and subassemblies, conducting feasibility studies that enable its customers to confidently proceed with full-scale projects. Nearly 70% of the lab’s work is for programs in nuclear deterrence, advanced science and technology and global security.

Bo takes pride in welcoming all comers. Nearly a third of the lab’s customers come from outside Sandia, ranging from the

Department of Defense and NASA to outside organizations and industry.

“There’s no material we cannot test,” he said. “We evaluate the nature, properties and strength of materials and how they change in different testing configurations or conditions. In the end, our customers receive a breakdown of material properties, and our materials experts provide counsel on how to improve the customer’s material design and selection.”

Anatomy of the lab

Under myriad combinations of controlled temperatures, pressures and velocities, the lab conducts pure research and development on the mechanics of materials under extreme conditions with remarkable precision.

In meticulous concert, the lab’s instrumentation crushes, compacts, twists, pulls and stretches materials under various controlled states of hot and cold to assess their pliability, durability and reliability. Materials range from rock and concrete to metal alloys to ceramics, plastics, rubbers and foams.

The lab’s crown jewel is its 1-inch-diameter Drop-Hopkinson bar with a carriage of up to 300 pounds — the only one



BANG! — Upon impact, custom-made sensors measure the force being applied and displacement of the material being tested.

of its kind in the world — used to measure the tensile properties of materials under low to intermediate impact velocities. The unique apparatus can simulate accidental drop or low-speed crash environments for evaluating various materials used in national security programs and private industry alike.

Central to the lab’s testing capabilities are two 1-inch diameter, 30-foot long steel or aluminum Kolsky bars driven pneumatically to speeds of a bullet train in either compression or tension mode. The bars are named after Herbert Kolsky, who in 1949 refined a technique by Bertram Hopkinson for testing the dynamic stress-strain response of materials. Another 3-inch-diameter steel bar is used for mechanical shock tests on large-size material samples or components.

In all these bars, samples of materials are placed in the center of the apparatus and stress waves are activated through a gas gun. Custom-made sensors were developed in the lab to measure the force being applied and displacement of the material being tested.

The lab also is fitted with an environmental chamber and induction heater that

can take temperatures up to 1,200 degrees C (2,192 degrees F, or roughly the temperature of lava in a volcano) or down to minus 150 degrees C (minus 238 degrees F, or about four times colder than the average temperature at the South Pole) to test materials under extreme conditions. “We designed and built a computer-controlled Kolsky bar that uses a furnace and robotic arm to precisely heat and place the material for testing,” Bo said.

When the specimen has reached the proper temperature, the robotic arm retracts and positions the sample, a mechanical slider moves the transmission bar so that the sample is in contact with both bars, and then the striker bar is fired to compress the sample. All this takes fewer than 10 milliseconds, or about one-tenth the time of an eye blink.

To measure the displacement, strain and temperature of material during impact, an optical table is rigged with a high-speed camera that collects optical images at up to 5 million frames per second. An infrared camera measures heat at up to 100,000 frames per second.

“This is a dynamic lab that we’re continually designing to meet our customers’ needs,” Bo said. “We love the challenges they bring to us.”

Picking up ideas along the way

The lab’s successes haven’t come easy. Bo has used all his 30-plus years of education and experience in experimental impact materials testing to build and customize the Sandia lab.

His introduction to the Hopkinson Bar, the predecessor to the Kolsky Bar, came by happenstance as a student at the University of Science and Technology of China, a national research university and China’s equivalent to the Ivy League. A professor who was starting a new impact mechanics lab asked Bo to be his first full-time student. “I didn’t even know what a Hopkinson Bar was at the time,” he said.

But he accepted the offer, grateful for the opportunity. He was equally grateful for his education, which was not guaranteed in China.

“My parents didn’t have the benefit of attending a university,” Bo said. “But they knew the value and importance of

education in how I could explore ideas and people. My parents understood that the key to my future was to be well-educated, so they sent me to good schools and supported me getting a doctorate.”


While some doors opened for Bo, he actively sought others. After earning his doctorate, he began to survey his career options outside China. He searched in the U.S., Australia and Europe and ultimately landed at the University of Arizona in Tucson as a postdoctoral researcher in a material dynamic testing lab. Bo spent four years there and when the entire lab moved to Purdue University in Indiana, he moved with it.

At the universities of Arizona and Purdue, Bo was working on several Department of Defense materials testing projects that included Sandia. The more he worked with colleagues from the labs, the more he became interested in Sandia. He applied for and accepted a position with Sandia/California in 2008. Five years, a wife and two kids later, he found his way to New Mexico.

Bo credits his University of China mentor for teaching him more than technical know-how. “He also was instrumental in showing me how a lab functions as a business and how to cultivate connections,” Bo said. “In my first three months in New Mexico, I never sat in my office. I was either in the lab conducting tests and building our capabilities or I was knocking on Sandia doors looking for collaborators and connections.”

Today, the lab’s original national security mission has expanded to include geological materials, small business support, automotive technology and more.

“There are not many labs around the world that can do what we do,” Bo said. “We’re becoming known as one of the leading facilities globally in experimental impact mechanics.”

Information on Sandia’s Experimental Impact Mechanics Lab is available by email, bsong@sandia.gov or phone, 505-844-4285. 

MISSION
FORWARD

This is
why I got
vaccinated.



They're safe. They keep you safe. They keep others safe. coronavirus.sandia.gov

Recent Patents

January – March 2021

- **Andrea Ambrosini and Eric Nicholas Coker:** Redox-active oxide materials for thermal energy storage. Patent #10800665
- **Hongyou Fan:** Method to synthesize metal halide perovskite particles with high luminescence and stability. Patent #10800798
- **Robert W. Brocato, Jack David Flicker, Robert Kaplar, Jason C. Neely, Lee Joshua Rashkin and Joshua Stewart:** Passive high-power-density grid interface device. Patent #10886841
- **Calvin Chan:** Proof-of-work for securing IOT and autonomous systems. Patent #10887107
- **Nelson S. Bell, Paul G. Clem, James J. M. Griego and Mark A. Rodriguez:** Vanadium oxide for infrared coatings and methods thereof. Patent #10889506
- **James Bradley Aimone:** Adaptive neural network management system. Patent #10891540
- **Alejandro J. Grine, Gregory M. Peake, Darwin K. Serkland and Michael Wood:** Narrow-linewidth single-mode vertical-cavity surface-emitting laser. Patent #10892600
- **Patrick V. Brady:** Surface blocking agents. Patent #10894913
- **Ryan Wesley David, Anthe George and Eric Monroe:** Octane hyperboosting in fuel blends. Patent #10899988
- **Timothy James Blada, Stephen Buerger, Adam James Foris, David W. Raymond, Steven James Spencer and Jiann-Cherng Su:** Control systems and methods to enable autonomous drilling. Patent #10900343
- **Edward Steven Jimenez Jr. and Kyle R. Thompson:** Automatic method of material identification for computed tomography. Patent #10908098
- **Salvatore Campione, Ting S. Luk, Darwin K. Serkland, Joshua Shank and Michael Wood:** Electroabsorption optical modulator. Patent #10908438
- **Salvatore Campione, Ting S. Luk, Isak C. Reines, Darwin K. Serkland, Joshua Shank and Michael Wood:** Methods of epsilon-near-zero optical modulation. Patent #10908440
- **Reinhard Willi Brock, Adam Jones, Randolph R. Kay, Seethambal S. Mani, Andrew Pomerene and Andrew Lea Starbuck:** Method of fabricating photosensitive devices with reduced process-temperature budget. Patent #10910508
- **Clifford K. Ho:** Multi-stage falling particle receivers. Patent #10914493
- **Nedra Bonal and Leiph Preston:** Muon detectors, systems and methods. Patent #10921468
- **Panit Clifton Howard:** Disposable garment and donning system. Patent #10925424
- **Gregory A. Ten Eyck:** Electronic circuit for control or coupling of single harges or spins and methods therefor. Patent #10929769
- **Rick A. Kellogg, Marshall Klee, Michael E. McReaken, Bradley Salzbrenner and Charles A. Walker:** Hermetic edge-connect headers and corresponding connectors. Patent #10931059
- **Patrick F. Fleig and Oscar Negrete:** Expanded pore particles and delivery methods thereof. Patent #10933027
- **Clifford K. Ho:** Solar thermal receivers with multi-scale light trapping geometry and features. Patent #10935281
- **Hongyou Fan:** Self-assembly method for core/shell nanoparticles with enhanced emission. Patent #10934481 B2
- **Nicolas Argibay, Tomas Farley Babuska, Michael E. Chandross, John Curry, Michael T. Dugger and Brendan L. Nation:** Diamond-like carbon films and uses thereof. Patent #10941485
- **Jason Hamlet, Ryan Helinski and William A. Zortman:** Integrated circuit authentication from a die material measurement. Patent #10942215
- **Hongyou Fan:** Method to synthesize nanoparticle supercrystals. Patent #10947116
- **Bryan James Kaehr:** Shape-preserving polymeric replication of biological matter. Patent #10947349
- **Ryan Wesley Davis:** Terpene synthases for biofuel production and methods thereof. Patent #10947563
- **Sapan Agarwal and Matthew Marinella:** Two-terminal electronic charge resistance switching device. Patent #10950790
- **Douglas G. Brown, Dahlon D. Chu, Dominic A. Perea, Kevin Robbins, John L. Russell and David A. Wiegandt:** Ultra-high reliability wireless communication systems and methods. Patent #10952123
- **Brad Boyce, Ross L. Burchard and Kristopher R. Klingler:** Inspection workcell. Patent #10955429

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 ([uspto.gov](https://www.uspto.gov)).



Human Resources
For your life and work

WE'RE LISTENING

Tell us about what's working and not working in your experience as a Sandian through the Employee Engagement Survey. Provide feedback on your job duties, training, company direction, recognition, diversity, and more.

Hurry! The survey closes June 2nd.

<http://listening.sandia.gov>



Sandia celebrates Asian American and Pacific Islander Heritage Month at museum

Virtual event at museum addresses culture, tradition and COVID-19 anti-AAPI violence

By **Stephanie Holinka**

The 24th Asian American and Pacific Islander Heritage Festival at the National Museum of Nuclear Science and History went for higher tech and a virtual presence this year. The festival was held Saturday, May 8, in conjunction with the May observation of Asian American and Pacific Islander Heritage Month, and was co-hosted by Sandia's Asian Leadership and Outreach Committee.

The festival opened with remarks from Labs Director James Peery and Jim Walther, executive director of the National Museum of Nuclear Science and History.

James specifically addressed the increase in verbal and physical attacks against AAPIO people in the nation, especially against women and the elderly.

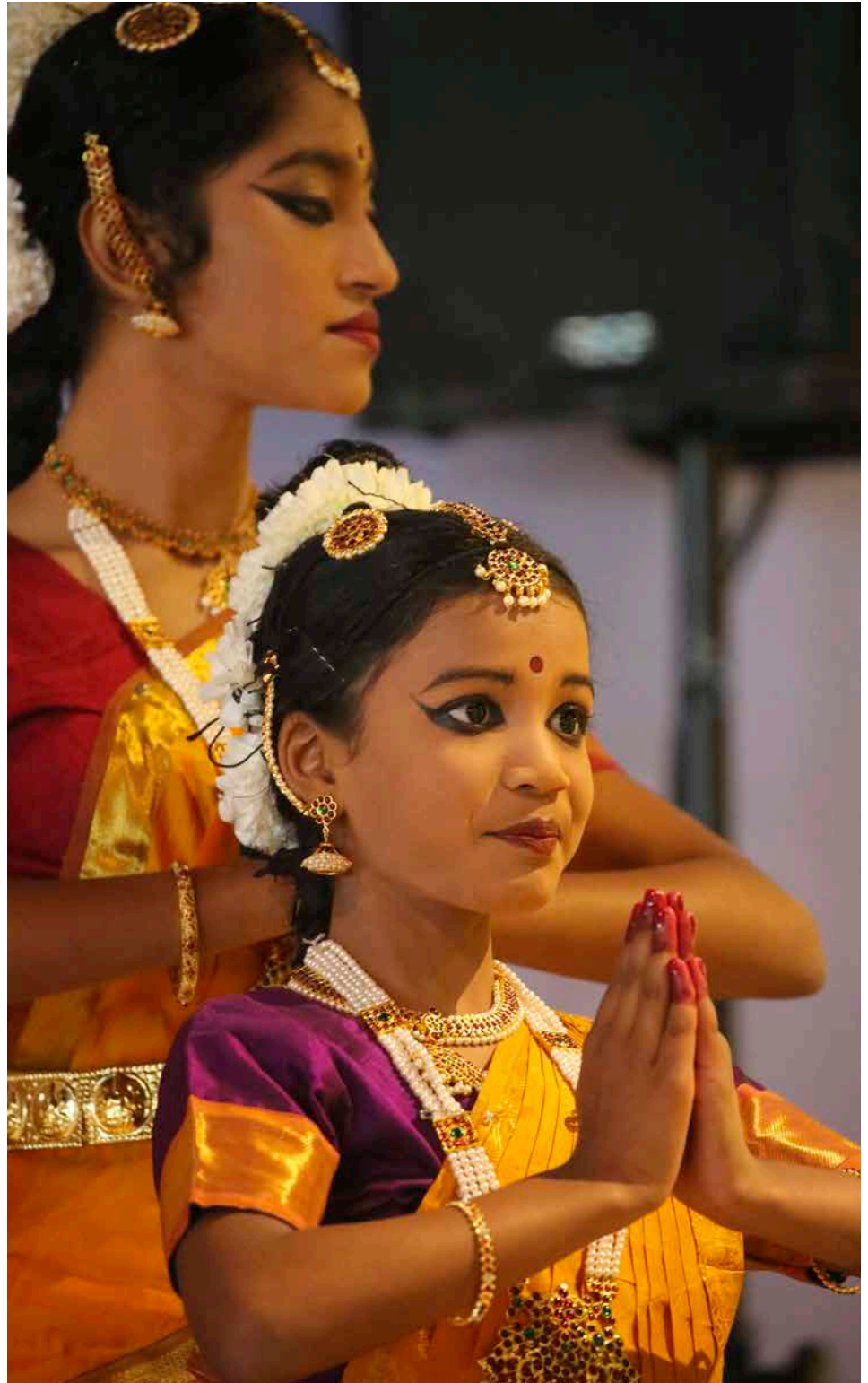
"We stand in solidarity with the AAPIO community," James said.

Jim called the event "one of the most important and largest events the museum sponsors each year."

Live events featured a talk by researcher Cliff Ho about his research on COVID-19 and ventilation, a martial arts Q&A session hosted by the Chinese Culture Center during their Tai Chi class and a candid discussion about hate crimes and civil rights.

Opening remarks and videos from several organizations highlighting important cultural practices and traditions from throughout the world rounded out the program. They included, by request:

- Opening remarks (Jim Walther and James Peery)
- The Chinese fan dance "**The Blooming of Indigowood Flower**," Albuquerque Chinese Folk Dance Ensemble
- Mongolia Dance, "Horizon," Albuquerque Chinese Folk Dance Ensemble
- Erhu (Chinese traditional instrument) Performance by Christina Yu, Association of Chinese-American Engineers and Scientists, New Mexico



DANCING AT THE MUSEUM — Performers presented Indian classical dance in 2019 at the museum for that year's AAPIO event. For more information, go online. **Photo by Lonnie Anderson**

- Sweet potato shrimp ball [Cooking Demonstration](#), Association of Chinese-American Engineers and Scientists, New Mexico
- BK Taiko Asian American and Pacific Islanders Heritage Day [drum demonstration](#)
- HA`AHEO O HAWAII [dance](#)

- [Ikebana](#) (Japanese flower design) presentation, Ichiyo School of Ikebana
- [Chinese calligraphy](#) demonstration, New Mexico Chinese School of Art and Language
- Horse Folding origami demonstration, New Mexico Chinese School of Art and Language
- Weyrich Gallery walkthrough of

[Arita porcelain at UNM](#)

Sandia's ALOC organization works to support the Labs in achieving and maintaining an equitable hiring of Asian Americans; supports Asian-American employees in their career development and growth; and supports Sandia in achieving and maintaining an equitable representation of Asian Americans at all levels. [fb](#)

Retiree Deaths

Sept. 4, 2020-Mar. 31, 2021

Frederic March (age 83)	Sept. 4
Robert Clay (100)	Nov. 1
Wilbur Boyd (88)	Nov. 1
Kathleen Cash (80)	Nov. 3
Edwin Wittwer (92)	Nov. 3
Lynn Ritchie (86)	Nov. 4
Gary Montague (84)	Nov. 6
William Barton (91)	Nov. 8
Kenneth Wischmann (85)	Nov. 9
Lizbette Cox (85)	Nov. 9
Norma Goodwin (94)	Nov. 14
Edward Patterson (89)	Nov. 15
Richard Salzbrenner (72)	Nov. 16
Marion Wilde (69)	Nov. 16
John Deasy (81)	Nov. 17
Diana Rutan (77)	Nov. 18
Hugh Sumlin (92)	Nov. 19
Harold Bennett (89)	Nov. 23
Edward Sanchez (66)	Nov. 24
John Dolce (68)	Nov. 25
Gloria Canon (86)	Nov. 28
Clarence Kassens (102)	Nov. 29
S. Carrillo (90)	Dec. 1
Marlyn Sterk (79)	Dec. 1
General Holman (82)	Dec. 3
Alfred Sanchez (70)	Dec. 4
Duane Stenberg (90)	Dec. 4
Charles Oien (68)	Dec. 5
Lee Heames (90)	Dec. 5
Richard Hay (77)	Dec. 6
John Robert Lujan (64)	Dec. 8

Howard Gipson (86)	Dec. 8
Marvin Bauder (88)	Dec. 12
James Stoeve (95)	Dec. 16
Leonard Parsons (95)	Dec. 16
Joe Sanchez (91)	Dec. 16
Fayne Shead (95)	Dec. 22
Kenneth Sansone (68)	Dec. 22
Felipita Pino-Lucero (77)	Dec. 24
Louellen Baldoni (80)	Dec. 25
Arthur Key (84)	Dec. 27
James Aragon (72)	Dec. 28
Floyd Gentry (77)	Dec. 28
Jonathan Miller (73)	Dec. 29
Virginia Dalin (85)	Dec. 29
Kenneth Gillespie (97)	Dec. 30
Donald Duran (89)	Dec. 30
Adolfo Maes (87)	Jan. 1
Richard MacGibbon (76)	Jan. 1
Donald Cowgill (79)	Jan. 1
Paul Plomp (78)	Jan. 2
Paula Ross (95)	Jan. 3
Gerald Hargiss (74)	Jan. 4
Ruben Trujillo (97)	Jan. 4
Fred Wolfenbarger (88)	Jan. 4
Gloria Hultine (81)	Jan. 6
Charles Gray (77)	Jan. 8
Robert Kutarnia (100)	Jan. 9
Donald Chenoweth (84)	Jan. 13
Jack St. Clair (96)	Jan. 15
Frank Rivera (95)	Jan. 15
Leo Gomez (80)	Jan. 17
Fred Clifford (91)	Jan. 18
Meredith Gower (78)	Jan. 24
Neilan Botsford (87)	Jan. 27
Leopoldo Armijo (89)	Jan. 27

Christine Burroughs (68)	Jan. 29
Robert Luikens (94)	Jan. 31
Mary Gachupin (63)	Feb. 3
Leland Stone (90)	Feb. 3
James Kannolt (89)	Feb. 5
Elwin Chestor (95)	Feb. 7
Anita Smith (89)	Feb. 8
Naomi Tackett (95)	Feb. 8
Frank Castillo (95)	Feb. 9
Richard Stammer (94)	Feb. 13
Manuel Barreras (63)	Feb. 15
Billy Stanton (84)	Feb. 16
Peggy Lee Box (92)	Feb. 17
Richard Coughenour (87)	Feb. 19
Richard Vigil (89)	Feb. 19
Joseph Kubas (74)	Feb. 21
Lyle Guynes (99)	Feb. 23
William Geck (90)	Feb. 23
Charles Simpson (85)	Feb. 27
Max Schell (87)	Feb. 28
James Norton (67)	March 2
Russell Maxwell (96)	March 6
J. Michael Griesmeyer (71)	March 7
Dorsey Bishop (84)	March 11
Joe Jaramillo (78)	March 13
Barry Butcher (87)	March 13
Alfred Herrera (94)	March 16
Joseph Calek (92)	March 21
Frederick Dippold (85)	March 21
Juan Serrano (91)	March 22
Johnny Molina (63)	March 23
Philip Hargis (76)	March 26
Ray Reed (93)	March 26
Gerald McCoach (84)	March 29

Labs shows respect with new accessible parking signs



THIS IS THE SPOT — Facilities team members, left to right, Anthony Francia and Natividad Chavez replace accessible parking signs in the parking lot north of Technical Area 1.

Photos by Lonnie Anderson

By **Victoria Newton**

A project to replace accessible parking signs around the Labs is finished, thanks to the efforts of security professional Mike Kline and Human Resources Executive Director John Myers, along with the Labs' facilities organizations and the Abilities Champions of Sandia.

Mike, a military veteran, proposed changing the signs from handicapped parking to reserved parking, with the traditional symbol.

"Handicapped is a negative word that makes me feel less than," Mike said. "People say it's only a word, but the word hurts. It's negative. The International Symbol of Access, also known as the Wheelchair Symbol, makes no mention of handicapped or disabled and it's recognized as a place for people who may need special access. It doesn't need to say disabled — we all understand the meaning."

John is executive champion for the Abilities Champions, Sandia's Employee

Resource Group that advocates for and supports individuals with disabilities. He eagerly awaited completion of the project.

"Although changing the parking signs may appear to be trivial, I would argue that for employees who use these spaces, this type of nuanced action is the foundation to becoming what we as a Lab aspire to be — a place where everyone is and feels valued, has confidence that their differences are appreciated and treasured and for job candidates to see Sandia as a unique and refreshing employer of choice," John said.

Hidden disabilities recognized


Completion of the project he proposed also was important to Mike, who has hidden disabilities.

"People may not actually know I have challenges, unless I choose to share them," he said. "As I operate as an able-bodied individual 100% of the time, I have learned to overcompensate for my disabilities for the most part."

Members of the Abilities Champions praised the change, commenting that

removing the stigma associated with the term "handicapped" leads to greater acceptance of limitations. They said people shouldn't judge those who use the accessible parking spaces and instead seek to understand their challenges.

To obtain an accessible parking permit, which are valid only on Sandia-controlled premises, review the medical restrictions section of the [Onsite Medical Services Policy, EHS002](#). The permits typically are limited to 60 days, but for an extended need, state-issued permits can be obtained through the New Mexico Motor Vehicle Department. Sandia/California already uses the accessible parking signs as the word "handicapped" is not included on accessible parking signs per California law.

"When we holistically focus our attention on the details of mission problems, we successfully find and deliver unbelievable outcomes for the nation," John said. "When we pay attention to the details of inclusion, we will do the same for our people. We unleash the power of Sandia, literally and figuratively." 

Sandia petroleum engineer featured on DOE Women in STEM

By ***Sarah Jewel Johnson***

The DOE is highlighting Sandia petroleum engineer Tonya Ross as an inspiring female engineer through its **DOE Women @ Energy: STEM Rising** website, which honors women in STEM fields throughout the DOE complex.

Tonya started as a contractor at Sandia in 2017 in environmental planning. She accepted a position as a systems engineer in June 2018 and immediately contributed to mission success through a comprehensive hazard analysis/risk assessment of the Radioactive Mixed Waste Management Facility. Tonya led the effort to develop and implement a sitewide hazard analysis and qualitative risk assessment process that supports all aspects of work at the Labs.

Tonya also does geomechanical modeling, and in February 2021 she moved into the geotechnology organization, where she creates and reviews two-dimensional finite element meshes to support the underground oil storage caverns in salt domes for the Strategic Petroleum Reserve.

Tonya immigrated from Guyana and studied at Prince George's Community College in Maryland and then at New Mexico Tech, where she received a bachelor's in petroleum engineering in 2013. Tonya's professors urged her to continue into a master's program, which she completed in May 2015. In the meantime, she worked with ConocoPhillips, exploring field development planning, designing and optimizing surface facilities and piping systems.

Her graduate research, "A Sensitivity Analysis of Steam Injection for Naturally Fractured Light Oil Reservoir," analyzed different recovery mechanisms during steam injection for three types of fluid samples (light, medium and heavy) in non-fractured and naturally fractured reservoirs using computational analysis of thermal phase behaviors of fluids in ultra-low permeability formations.

Tonya is pursuing a second master's degree in engineering management and a doctorate in petroleum engineering from New Mexico Tech. Her current research, "Improved Sweep During Polymer Flooding by Controlling Sand Movement," is based on efforts to improve enhanced oil recovery operations in oil reservoirs located in unconsolidated sands.

I interviewed Tonya for her feature spot on the DOE Women @ Energy website.

Q What inspired you to work in STEM?

I enjoyed math and sciences classes growing up, coupled with my curious mindset as a child, I wanted to know the what, the why and the how of different processes, equipment and even nature. Growing up in Guyana as the fourth out of five children in a single-parent home, I watched shows on the television and was curious about how the television generated the images. So, I took the family television apart to discover what was inside and how the parts fit together. My mom was not a big fan of the idea. My curious mindset drove me into the STEM field the same way it drove me to take apart the television when I was young.

I knew I wanted to do engineering, but I didn't know what type of engineering to do. When I first moved to the United States, everyone suggested nursing because it's traditionally a female profession, and they said engineering would be too hard for a female. I don't like limitations, so I just thought, 'I can do this! I'm not going to let being a female turn me away from doing anything I want.'

After presenting at the honor society conference on the "Innovation in the Field of Engineering," I became interested in petroleum engineering because I wanted to understand more about petroleum products, how those products are processed from the subsurface, and the movement of those products at surface and subsurface level. Even though being an engineer can



STEM RISING — Sandia petroleum engineer Tonya Ross was recognized by DOE as an inspiring female engineer. **Photo courtesy of Tonya Ross**

be challenging, working in STEM is so rewarding. If you have a core understanding of engineering and put your mind to it, you can apply engineering to many things. For example, system safety engineering has nothing to do with petroleum, but my understanding of the petroleum engineering process helped link the concepts.

Q What excites you about your work at the Energy Department?

What excited me about our work in the Energy Department is that it's never the same. Engineering pairs nicely with my curious mindset, and I love a challenge. At Sandia, something new happens all the time, and I regularly find things that I didn't know existed. I think it's so important to try to expand your knowledge base constantly.

During my time in the ES&H Planning Department as a systems engineer, I worked on hazard analysis and qualitative risk assessments with different line partners across Sandia. We looked at various factors to ensure that the workers, the environment and the mission are safe. Work

that incorporates so many people opens so many opportunities to touch different processes of the lab.

I support various projects for the Geotechnology and Engineering Department. For the U.S. Strategic Petroleum Reserve, I model the mechanical behavior of oil storage caverns built in salt domes. The four salt domes where oil is stored each have a dome-scale finite element geomechanical model that evaluates the creep behavior of the salt in response to the altered stress conditions caused by the presence of the caverns, and the effect on surface and subsurface infrastructure at the facilities. My contributions in this area have strengthened Sandia's modeling capabilities that are crucial to its technical advisory role for the SPR. My work here at Sandia is exciting because there are lots of opportunities for innovation. It's never limiting. You are in control of where you go, especially at Sandia. You can decide to go the management route, stay on the technical or research path or be super technical. There is so much flexibility, and I love it.

Q How can our country engage more women, girls and other underrepresented groups in STEM?

There are various ways to engage more women, girls and other underrepresented groups in STEM. Some of these include having more women role models in STEM. As a female professional entering in a STEM field, the first thing I do is look at the leadership of a company because it tells a story, particularly as a female, of where my cap may be within the industry. Engaging women, girls and other underrepresented groups means breaking stereotypes and showing the various groups anyone can be in the STEM field. We need to avoid generalizing roles and career paths based on gender and create awareness for opportunities. I have volunteered at various groups that help get the word out and motivate underrepresented groups to work in STEM, such as the Society of Women Engineers and the National Society of Black Engineers.

Finally, engaging underrepresented groups means having more involvement. It means taking STEM programs to

underserved areas and engraining education into the communities.


Q Do you have tips you'd recommend for someone looking to enter your field of work?

I'd recommend to anyone trying to enter the STEM field — especially women, girls and other underrepresented groups — to be confident, passionate and willing to work hard. It is also important to note that making a mistake does not equal failure. Instead, young engineers should accept that mistakes happen and use them as an opportunity to grow, rather than being defined by a mistake.

I would also say networking is a crucial part of this field. Knowing your self-worth and understanding who you are as a person is critical. Knowing who you are will help you succeed in any environment and give you the courage to push back if needed. It is also vital to have support systems that will encourage you to keep learning and growing in the STEM field.

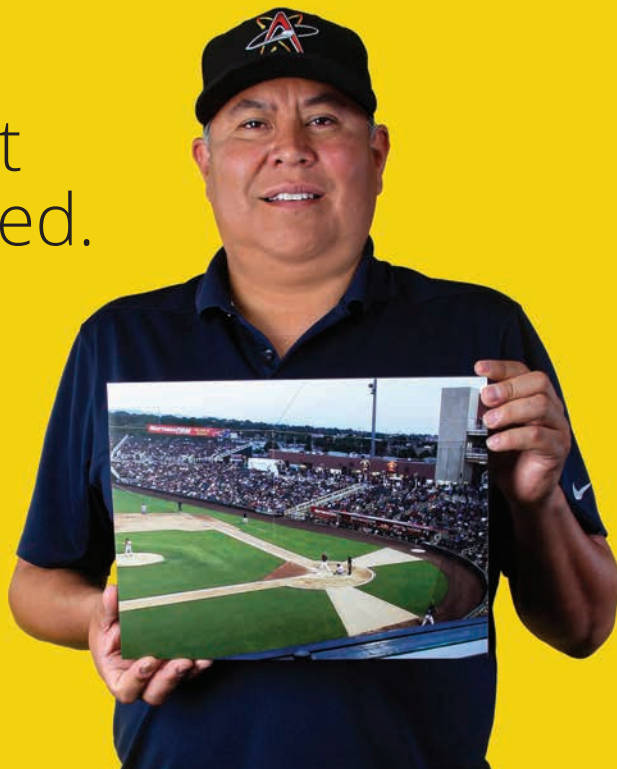
Q When you have free time, what are your hobbies?

Well, with my limited free time, I love to volunteer — it's something I feel I need to do. I love to play and watch rugby. I used to coach middle school rugby in Houston, and I volunteered at the hospital and the Big Brothers Big Sisters program. Now I volunteer as a co-lecturer for the petroleum engineering senior design class at New Mexico Tech, where I review and critique senior design projects.

I love to travel because understanding culture helps you embrace a new perspective in life and have an open mindset. I also love to read world history. As an immigrant into this country, I'm interested in learning about U.S. history because there is so much to learn, and I don't want to be ignorant about the history. I think it's easy to get caught up in surface discussions with others, so I take time to learn how history fits into the current day and why things work the way they do. I have the mindset that I should be learning all the time! 

MISSION
FORWARD

This is
why I got
vaccinated.



They're safe. They keep you safe. They keep others safe.

coronavirus.sandia.gov