



# Successful crash test meets major milestone for nuclear deterrence program

## Sandia team worked through COVID-19 challenges, delivered results on time



**FLEET QUALIFICATION** — Data from the Mobile Guardian Transporter crash test will be used for qualification of the transporter and to better understand cargo response in accident scenarios for years to come.

Photo courtesy of Sandia National Laboratories

By **Manette Newbold Fisher**

A full-scale crash test involving a semitruck impacting the side of the first prototype of a new weapons transporter successfully took place at Sandia this summer.

Using the Labs' sled track, rockets propelled the semitractor-trailer at highway speeds into the prototype, an over-the-road **Mobile Guardian Transporter** conceptualized and built from scratch. Data from the event will be used for qualification of the transporter and to better understand cargo response in accident scenarios for years to come.

This test met a major milestone for NNSA as part of the Labs' nuclear deterrence program, said Gary Laughlin, Sandia director over the

program. Eventually, the new transporters will replace the current fleet of vehicles that safely and securely move nuclear assets within the United States.

"Completing this milestone is one example of Sandia's dedication to the Office of Secure Transportation and the nuclear deterrence program," Gary said. "Very creatively and with the help of many teams throughout Sandia, Los Alamos and Lawrence Livermore national laboratories, we figured out how to build a new trailer and complete a test that was flawlessly executed."

### Biggest crash test in decades

Crash tests at this scale using transporter vehicles have not taken place at the Labs for about 20

years, said Jim Redmond, senior manager over the program, adding that Sandia has never executed a test quite like this one at full scale.

"About two decades ago, Sandia crashed a truck into an immovable barrier, but this is the first time we've done a test in this configuration, where we took a truck at full capacity and propelled it down the track and hit our test article sitting idly at the end of it," Jim said. "In two decades, you can imagine how much technology has advanced in terms of our ability to measure responses of the trailer and its contents."

One purpose of the crash test, said manager Daniel Wilcox, was to ensure the new fleet of semi-trailer transporters will be able to keep cargo safe in the event of an unexpected crash.

Sandia's primary mission is ensuring the U.S. nuclear arsenal is safe, secure and reliable. As part of that mission, and since the inception of nuclear deterrence, Sandia has played an **important role in transportation**, Jim said.

"The transportation mission is a critical component of an effective nuclear deterrent," he said. "It provides needed assurance to the American public and our allies of the safety and security of our stockpile. You've got to be able to ship nuclear assets safely and securely or you don't have a deterrence program."

### Starting 'with a clean sheet of paper'

Sandia manager Barry Boughton was part of the team that worked on the previous fleet of transporters that have been in use since the 1990s. Following testing on additional prototypes in coming years, the current set of transporters will be replaced by the Mobile Guardian Transporter fleet, which is expected to be in service beyond 2050.

Barry said the transporter systems begin with demanding requirements that change with each fleet as technology and the operating environment evolve. From there, the design team begins creating a brand-new system.

"The Mobile Guardian Transporters are not an extension of the old trailers," he said. "We started with a clean sheet of paper."

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**STATE OF THE STOCKPILE** — Labs Director James S. Peery signed the annual nuclear weapons stockpile assessment letter on Sept. 23. The letter signing concludes many months of work assessing the state of the U.S. nuclear weapons stockpile.

Photo by Bret Latta

## Peery signs annual stockpile assessment letter

Laboratories Director James S. Peery signed Sandia's annual nuclear weapons stockpile assessment letter on Sept. 23. Completion of this annual assessment letter is one of the labs director's principal responsibilities and is required by law.

The annual assessment encompasses the safety, reliability and performance of the nation's nuclear weapons stockpile for which Sandia is responsible. The process requires a set of comprehensive expert reviews, both internal and external, for each weapon system.

The letter signing represents the culmination of many months of work engaging every division at Sandia.

The directors of Sandia, Los Alamos and Lawrence Livermore national laboratories (NNSA's three nuclear weapons labs) and the commander of U.S. Strategic Command each provide an annual assessment letter to the secretaries of energy and defense and the Nuclear Weapons Council. The letters are then submitted, unaltered, to the president along with the secretaries' conclusions on the safety, reliability, performance and military effectiveness of the nuclear weapons stockpile.

## Herrera appointed to national quantum computing advisory committee

By **Troy Rummler**

**S**andia Fellow Gil Herrera has been appointed to the newly established U.S. National Quantum Initiative Advisory Committee.

Gil is one of two committee members representing the DOE national laboratories. He joins 20 others from government, industry and academia tasked with advising the nation's highest offices on matters concerning quantum information science. His appointment is for three years.

Quantum information science — a broad field of study that includes quantum computing — concerns machines that accomplish extraordinary tasks by manipulating matter at the smallest scales.

“Quantum computing represents both an exceptional opportunity and a dire threat,” Gil said. “On the positive side, when useful quantum computers can be built, they could solve molecular chemistry problems that could significantly reduce worldwide energy consumption or facilitate the rapid development of pharmaceuticals. On a more negative note, a quantum computer threatens public key encryption that protects almost all secure web communications.”

In August, Sandia and more than a dozen collaborators, collectively called the **Quantum Systems Accelerator**, were selected as one of five national quantum research centers.

The **national advisory committee**, established on Aug. 28, informs offices such as the president and the secretary of energy about how to maintain U.S. leadership in this area of technology.

“To me, leadership means that U.S. companies have the highest performing quantum computers, from qubits through apps, and the best quantum sensors and communication systems,” Gil said. “Of equal importance, the U.S. quantum information technologies are not reliant on supply chains

or intellectual property outside of the U.S., and the benefits of the U.S. government investments in quantum information science extend to all Americans, including those who manufacture quantum computing, sensing and communications systems.”

A qubit is the basic processing unit of a quantum computer, analogous to a bit in a conventional computer.

### One program, many applications

Of his new appointment, which he will hold concurrently with his position at Sandia, Gil said, “I hope to help the program achieve a balance between the needs of scientific advancement, commercial interests of U.S. businesses, and national security interests.”

Gil recently has been coordinating COVID-19 research efforts across Sandia's 14,000-strong workforce. A Sandia fellow since 2018, he also has spearheaded efforts to expand discovery research, served on an independent review team for a U.S. Department of Defense microelectronics program, and has mentored staff members ranging from new hires to directors.

He previously served as the director of Sandia's Microsystems Engineering, Science and Applications complex, which researches and produces quantum technology in addition to its main mission of producing specialized microelectronics for the nation's nuclear stockpile.

Gil has been director of the Laboratory for Physical Sciences — a joint University of Maryland and U.S. government research institute — and served at the White House Office of Science and



**QUANTUM ADVISER** — Sandia Fellow Gil Herrera has been appointed to the U.S. National Quantum Initiative Advisory Committee. **Photo by Randy Montoya**

Technology Policy as an American Association for the Advancement of Science/Sloan Fellow under President George H.W. Bush, where he worked on semiconductor and technology transfer policies.

He has received numerous awards for his service, including three Civilian Service medals from the Pentagon and the National Security Agency Research Medallion, and has received two distinguished alumni awards from the University of New Mexico.

Gil earned his master's degree in electrical engineering from the University of California, Berkeley. An Albuquerque native, he received his bachelor's degree in computer engineering from UNM. [f](#)



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### LABNEWS Notes

**EDITOR'S NOTE:** Lab News welcomes guest columnists who wish to tell their own “Sandia story” or offer their observations on life at the Labs or on science and technology in the news. If you have a column (500-800 words) or an idea to submit, contact Lab News editor Tim Deshler at [tadeshl@sandia.gov](mailto:tadeshl@sandia.gov).

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# Sandia Gives, stronger together



By **Katrina Wagner**

It started as an idea one family had to feed other families in need and keep restaurants in business when the pandemic hit.

“We felt helpless,” Sandia engineer Rachel Gupton said. “Schools weren’t open, restaurants weren’t open. We wanted to help, and went to the United Way of Central New Mexico, who helped bring our idea to life.”

**Feeding Families** was born, and community members raised \$223,000 to feed 1,575 families, serve 16,000 meals and provide business assistance to 41 restaurants. This is an example of the power of partnerships that can happen when working with the United Way. Together, our dollars can help the community in multiple ways. The United Way supports nonprofit organizations that demonstrate success in helping people reach educational and stability goals.

### Need is Now

In April, Sandia partnered with the United Way of Central New Mexico to mobilize a donation portal and create a campaign to help New Mexico’s tribal communities that were hit especially hard with COVID-19.

Sandia employees donated \$250,000 in a two-week period to help buy food, water and medical supplies. “That’s the most impressive thing I’ve seen in my 38 years at the United Way,” said Randy Woodcock, UWCNM’s vice president of corporate

relations. About 1,600 people donated to the Need is Now campaign, demonstrating that participants can choose to give an amount they can afford and the contributions together add up to make a big impact.

### Together Apart

The United Way Bay Area COVID-19 Community Relief Fund was established to address community needs by bringing together UWBA’s broad community network, corporate partners, local government agencies, schools and other community-based organizations.

Sandia mobilized to establish the Together Apart campaign. Sandia employees and the Corporate Contributions program contributed nearly \$20,000 that went toward COVID relief funds for both the UWBA and United Way of San Joaquin, to help those in need with things like food assistance and living expenses.

The COVID-19 Community Relief Fund has raised \$4.9 million to date and has distributed more than \$4.3 million to 97 nonprofit organizations across eight Bay Area counties.

“There was a huge ask in the community for rental relief when the pandemic hit,” said Kevin Zwick, UWBA executive director. “Everybody rolled up their sleeves and figured out how to meet this need.”

### Mission support

The UWCNM works with hundreds of community partners to focus and align the community around shared strategies designed to improve family stability and education through Mission: Families and Mission: Graduate.

These initiatives represent a comprehensive approach to improving outcomes for children, youth and families at scale in the central New Mexico region. The Community Impact Fund uses contributions to make the greatest impact by awarding grants to nonprofit programs also focused on family stability and education attainment. These UWCNM programs mirror the **Sandia Corporate Contributions** program, which also prioritizes funding for programs that support educational success and family stability.

Sandia employees can sign up to donate to the nonprofit organizations of their choice through the United Way during the annual Sandia Gives campaign, happening now. It doesn’t take a lot to make a big difference.

When there is a need, **Sandia shows up**. Employees have contributed more than \$117 million since 1957, and this year, donations are needed more than ever.

Sandia employees contributed about \$4.5 million during last year’s campaign, and retirees also made a significant impact, contributing \$700,000 to the campaign.

This year, the Sandia Gives campaign has set a goal to increase employee participation from 45% to 50%, to continue the Labs’ long-standing commitment to the communities where we live and work.

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UNITED WAY OF CENTRAL NEW MEXICO PRESIDENT RODNEY PRUNTY THANKS SANDIANS

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LABS DIRECTOR JAMES S. PEERY KICKS OFF 2020 SANDIA GIVES CAMPAIGN



Sandians — like Division 6000 role model Rachel Gupton — make an annual impact on local communities through contributions supporting educational success and family stability. You can make a difference today.

Show up to make your contribution and watch all our division role model “I Show Up” videos online.

WILL YOU SHOW UP?  
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# Bonano and Rivas earn HENAAC recognition

Nuclear waste management leader, cyber assurance architect honored by national Hispanic organization

By **Kristen Meub**

**T**wo experts at Sandia have been honored for their achievements and leadership as top engineers and scientists from the Hispanic community.

Evaristo “Tito” Bonano, senior manager of nuclear energy fuel cycle, and Angela “Ang” Rivas, cyber assurance architect, were recognized at the 32nd annual **Hispanic Engineer National Achievement Awards Conference** by Great Minds in STEM.

Tito received a Lifetime Achievement award and Ang received a Luminary award during the society’s annual conference in September, held virtually this year. To date, 43 Sandia employees have been recognized at HENAAC since 1994.



**FUELING INNOVATION** — Evaristo “Tito” Bonano, Sandia senior manager of nuclear energy fuel cycle, was honored with a Lifetime Achievement award at the 32nd annual Hispanic Engineer National Achievement Awards Conference by Great Minds in STEM.

Photo by **Lonnie Anderson**

## Tito Bonano: Lifetime Achievement award

Throughout his 37-year career, Tito has focused on the safety-related issues of nuclear technology, nuclear waste management and nuclear waste disposal, working to provide solutions for the safe disposal of highly radioactive nuclear waste. Early in his career, he worked as a researcher at Sandia and other institutions, and then became a small-business owner before coming back to Sandia to take on technical and managerial leadership roles.

In 2006, DOE designated Sandia as the lead laboratory on the Yucca Mountain Project, which sought to permanently dispose of high-level radioactive waste and spent nuclear fuel from both commercial and national defense use. Tito was elected to lead the preparation of the portion of the license application that described the work of hundreds of engineers and scientists from multiple laboratories, universities and private companies to demonstrate that spent nuclear fuel and high-level radioactive waste could be disposed of deep inside the Earth while protecting the health and safety of humans and the environment for tens of thousands of years.

“Having the opportunity to lead this critically important, complex effort and completing the license application in June 2008, which represented the culmination of over 30 years of work by hundreds of scientists and engineers from numerous organizations, is, without any doubt or reservation, the highlight of my professional career and an accomplishment that I will always be extremely proud of,” Tito said.

After the Nuclear Regulatory Commission accepted the license application, federal funding was withdrawn from Yucca Mountain in 2011, and the site has not progressed.

In his current role at Sandia, Tito oversees research in nuclear waste disposal while also directing programs in safety analysis for space launch missions, small modular reactors, advanced energy conversion systems, fuel cycle systems engineering

and analysis, storage and transportation of nuclear waste, and advanced modeling and simulation.

“Tito’s visionary leadership has grown Sandia’s nuclear effort substantially, despite a nationwide lull in nuclear power generation and nuclear waste disposal over the past 10 years,” said Labs Director James S. Peery. “Tito has positioned Sandia as the nation’s, and arguably the world’s, premier nuclear waste disposal research organization, a trusted technical adviser to DOE and a leading contributor to national and international nuclear waste disposal efforts in Australia, South Korea, at the International Atomic Energy Association in Vienna, Austria, and the Nuclear Energy Agency.”

Tito also has worked to build partnerships with Hispanic-serving universities to increase the pipeline of Hispanic engineers to Sandia.

Tito said that throughout his career, he learned much from others who mentored him, and he feels an obligation and a responsibility to share his experiences and lessons learned with those who will follow him.

“Knowledge transfer has become my passion at this point in my career, and there are four basic principles that have served me well, personally and professionally, that I want to share with the next generation of STEM professionals: have passion for and believe in what you do; always act with integrity regardless of the circumstances; never assume you know it all — respect and value the opinions of others; and always give credit to those you work with, for your accomplishments would not be possible without them,” he said.

Beyond mentoring and sharing his own experiences, Tito has set up a formal knowledge transfer program at Sandia to ensure that scientific and analytical expertise is passed on from one generation of engineers to the next.

“Tito’s vision has resulted in the creation of a state-of-the-art knowledge management program at Sandia,” said Rod McCullum, senior director of decommissioning and used fuel for the Nuclear Energy Institute, in his recommendation letter.

“His realization that continued government inaction will likely push the quest for a nuclear waste solution forward to yet another generation has led him to turn his dedication towards assuring that all of the scientific and analytical expertise that this generation has developed will remain available to those that follow,” Rod said. “Eventually, the U.S. will solve its nuclear waste problem. It cannot be known whether or not the world will then truly appreciate the role that Tito had in making this possible.”

Tito was born and raised in Puerto Rico. He graduated from the University of Puerto Rico, Mayaguez, with a degree in chemical engineering. He earned his master’s degree and doctorate in chemical engineering from Clarkson University, focusing on transport phenomena.

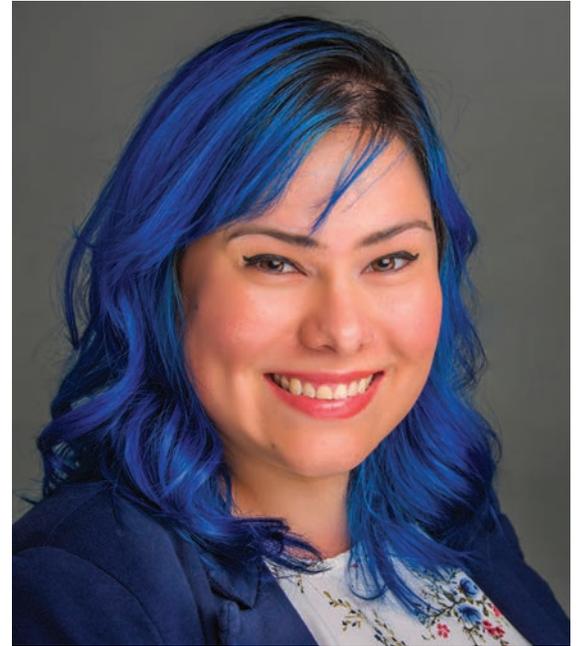
## Ang Rivas: Luminary award

Ang grew up in a multigenerational household in Albuquerque’s South Valley, where she said they had “no money, but lots of love.” She worked hard in school, taking college classes while still in high school and graduating when she was 16.

Ang pursued a triple major in technical communications, electrical engineering and computer science at New Mexico Tech. Shortly after her grandmother died, Ang focused on working to help support her family and be more financially secure. She first joined Sandia as an intern and then became an intellectual property administrator while taking classes at Central New Mexico Community College.

Ang said that for years, Sandia’s flexible and stable work environment enabled her to take care of her family. She continued her studies while working and earned a bachelor’s degree in technical communication from Arizona State University.

“My journey at Sandia has been a little nontraditional,” Ang said. “I like to help remind kids that they don’t have to take a linear journey from school to college to a career. It’s easier that way, but



**CYBER SUCCESS** — Angela “Ang” Rivas, Sandia cyber assurance architect, was honored with a Luminary award at the 32nd annual Hispanic Engineer National Achievement Awards Conference by Great Minds in STEM.

Photo by **Kim Jew Photography**

having been on a zigzag journey myself, I tell them you can figure things out as you go along, and you can get back on track when obstacles come your way. Don’t give up.”

Currently, Ang leads software security awareness and training. She has developed a training course on software security awareness, best practices and supply chain risk for members of software development teams, nuclear weapons engineers and cybersecurity professionals. She also has led and contributed to threat modeling engagements and found ways to incorporate her team’s software security expertise into internal review boards for software design and architecture.

“Angela Rivas is one of the most talented, motivated, versatile and team-oriented persons I have met in my 32+ years at Sandia,” said Joselyne Gallegos, senior manager of data and software security. “These characteristics make her a natural leader, one whom managers and experienced staff respect and listen to. No matter what role she is in, Ang redefines the role to be broader and more impactful than what is initially presented to her, subsequently demonstrating new and exciting possibilities.”

Ang proposed and established a pilot program at Sandia to develop software security champions throughout the Labs and has helped build relationships with other national laboratories that are developing software security programs.

“She has demonstrated passion and talent for data and software security, finding new and innovative ways to propel the program forward and inform its best practices for integrating security earlier into the software development lifecycle,” said Labs Director James S. Peery. “She is a dedicated engineer and natural leader with a bright future ahead of her.”

While continuing to grow in her career at Sandia, Ang is studying for a master’s degree in cybersecurity at New York University.

Ang said that when she has had to make big decisions about her career and job opportunities, she remembers the advice of her late uncle, who was like a father to her. He encouraged her to be fearless, telling her “you can do anything.” She said this advice has encouraged her to branch out and embrace new opportunities.

Outside of her work at Sandia, Ang has a passion for community service and mentoring. Last year, she was sworn in as a court-appointed special advocate volunteer with NM Kids Matter. She volunteers with multiple organizations to mentor young people in underserved communities and has been heavily involved with United Way of Central New Mexico’s Community Fund allocation panels and affinity groups. Ang also has volunteered at STEM events at schools and community centers in Albuquerque’s South Valley. 

# Machine-learning technique could improve fusion energy outputs

## Building a better reactor by modifying its walls

By Neal Singer

**M**achine-learning techniques, best known for teaching self-driving cars to stop at red lights, may soon help researchers around the world improve their control over the most complicated reaction known to science: nuclear fusion.

Fusion reactions are typically hydrogen atoms heated to form a gaseous cloud called a plasma that releases energy as the particles bang into each other and fuse. Getting these reactions under better control could create huge amounts of environmentally clean energy from nuclear reactors in fusion power plants of the future.

“The connection between machine learning and fusion energy is not obvious,” said Sandia researcher Aidan Thompson, principal investigator for a \$2.2 million, three-year DOE Office of Science award to make that connection. “Simply put, we have pioneered machine-learning’s use to improve simulations of the reactor’s wall material as it interacts with the plasma. This has been beyond the scope of atomic-scale simulations of the past.”

The expected result should suggest procedural or structural modifications to improve nuclear energy output, he said.

### Modeling nuclear fusion

Machine learning is powerful because it uses mathematical and statistical means to figure out a situation, rather than analyze every piece of data in the desired category. For example, only a small number of dog photos are needed to teach a recognition system the concept of “dogginess” — in other words, “this is a dog” — rather than scanning every dog photo in existence.

Sandia’s machine-learning approach to nuclear fusion is the same, but more complicated.

“It is not a trivial problem to physically observe what is going on within a reactor’s walls as these structures are internally bombarded with hydrogen, helium, deuterium and tritium as parts of a super-heated plasma,” Aidan said.

He described components of the circling plasma striking and altering the composition of the retaining walls, and heavy atoms dislodging from the struck walls and altering the plasma. Reactions take place in nanoseconds, at temperatures as hot as the sun. Trying to modify components using trial and error to improve outcomes is extraordinarily laborious.



**COOL FUSION** — Sandia machine learning and fusion researcher Aidan Thompson considers the future from the shelter of the Sandia “found art” piece titled Starburst. From 1980 to 1986, the structure was the power flow lines and target chamber of PBFA I, Sandia’s earliest major fusion attempt. **Photo by Randy Montoya**

Machine-learning algorithms, on the other hand, use computer-generated data without direct measurements from experiments and can yield information that eventually could be used to make plasma interactions with containment-wall material less damaging, and thus improve the overall energy output of fusion reactors.

“There is no other way of getting this information,” Aidan said.

### A few atoms predict energy of many

Aidan’s team expects that by using large datasets of quantum-mechanics calculations under extreme conditions as training data, they can build a machine-learning model that predicts the energy of any configuration of atoms.

This model, called a machine-learning inter-atomic potential, or MLIAP, can be inserted into huge classical molecular dynamics codes such as Sandia’s award-winning LAMMPS, or Large-scale Atomic/Molecular Massively Parallel Simulator, software. In this way, by interrogating only a relatively small number of atoms, they can extend the accuracy of quantum mechanics to the scale of millions of atoms needed to simulate the behavior of fusion energy materials.

“So, why is what we are doing machine learning and not just bookkeeping lots of data? The short

answer is, we generate equations from an infinite set of possible variables to build models that are grounded in physics but contain hundreds or thousands of parameters that keep us within range of our target,” Aidan said, defending the reality of the machine-learning process.

One catch is that the accuracy of the MLIAP model depends on the overlap between the training data and the actual atomic environments encountered by the application, Aidan said.

These environments may be various, requiring new training data and alteration of the machine-learning model. Recognizing and adjusting for overlaps is part of the work of the next few years.

“Our model at first will be used to interpret small experiments,” Aidan said. “Conversely, that experimental data will be used to validate our model, which can then be used to make predictions about what is happening in a full-scale fusion reactor.”

The target for giving fusion researchers access to the Sandia machine-learning models to build better fusion reactors is approximately three years, he said.

Team members include researchers from Los Alamos National Laboratory and the University of Tennessee at Knoxville, as well as Sandia researchers Habib Najm, Robert Kolasinski, Mitchell Wood, Julien Tranchida, Khachik Sargsyan, and Mary Alice Cusentino. [f](#)

## Safety class is still in session

By Karli Massey

**E**ven during a pandemic, required safety courses must go on. While many trainings have moved to virtual platforms, some classes just can’t be computer based. For example, rough terrain forklift training isn’t effective without the forklift and the terrain.

Since March, Sandia’s Environment, Safety & Health training teams have made changes to safety classes to accommodate social distancing and masking guidelines. They also have added more course sessions to accommodate smaller class sizes while making sure that employees can maintain their certifications.

“Many of these classes are required for our workforce to perform their job functions, and we didn’t want to turn anyone away from these essential safety trainings,” said John Milloway, safety engineering technologist and one of Sandia’s instructors.

Other types of classes that continue to be offered following COVID-19 safe practices include fall prevention and protection, crane and rigging, aerial lift operations, radiological worker training and CPR. [f](#)



**REACH FOR THE SKY** — Safety instructor John Milloway, left, provides guidance as Kimberly Massey controls a rough terrain forklift.



**STRAPPED IN** — John Bauer wears a safety harness required for operating heavy equipment.



**TURN, TURN, TURN** — John Bauer navigates a scissor lift through a slalom course. **Photos by Randy Montoya**

## Crash test

CONTINUED FROM PAGE 1

Nearly everything that makes up the transporters is custom designed and built, with a few exceptions. It was a multiyear design effort to get to the point where Sandia could work with an external partner to build the road-ready trailer. Initially, the prototype didn't have any electronics or finishing touches. Following the 13-month trailer build, the team worked for an additional six months assembling electronics before they began testing the prototype in normal and abnormal environments.

Normal environment tests included such activities as driving the transporter on the road while measuring shock and vibration response and exposing the vehicle to thermal cycling while measuring its response to various temperatures.

From January to June, the team prepped the vehicle for the crash test by setting up data-acquisition instrumentation and configuring and installing representative cargo. Setting up the channels was one of the most challenging technical aspects of test setup, said Kylen Johns, prototype project lead.

"We had a goal of gathering an unprecedented amount of data, realizing that it would be extremely difficult in such a harsh environment," she said. "To reduce risk, we built in redundancy to the systems and included peer reviewers in every step of the preparation. We were crashing a semi into another semi, and protecting these super tiny, thin cables meant the difference between getting critical data or missing major objectives."

During the test, more than 400 channels of data and video, including high-speed video, were collected, Jim said. Every sensor served a purpose and provided specific data that the team analyzes to make sure the transporter meets all requirements. The team will only build three prototypes, so every scrap of data is meaningful to the project.

### Test day collaboration

The complexity of the setup required the multi-organization crash test execution team and other collaborating groups to remain "laser-focused" for months, Daniel said, to ensure the crash date wasn't delayed, the test objectives were met and data wasn't compromised.

The prototype was moved to the test site in June, where employees continued preparing for the crash in pandemic conditions, in the heat of the desert — running cables, fixing problems, soldering wires, setting up cameras, checking acquisitions systems and setting triggers.

On test day, final preparation started several hours before dawn. Around midday, the test execution team, transporter team members and stakeholders stood at a safe distance from the sled track and watched the crash take place. There was a lot of buildup to that point, Jim said, with the



**TRANSPORTER CRASH TEST** — Using Sandia's sled track, rockets propelled the semitractor-trailer at highway speeds into a prototype of an over-the-road Mobile Guardian Transporter conceptualized and built from scratch.

Photo courtesy of Sandia National Laboratories



**OVERCOMING CHALLENGES** — Sandia quality engineer Dulce Barrera, left, and systems engineer and team lead Kylen Johns coordinated with colleagues to mitigate the challenges caused by COVID-19 during preparation for a full-scale crash test that took place this summer.

Photo by Bret Latter

years-long effort resulting in a transporter assembly test that was over in a matter of seconds.

"I was glad to see the rockets fired; I was glad to see it was successful," he said. "It was tense. The entire team, including partners from LANL and Lawrence Livermore, were excited and relieved. There's a lot of pride among the team, as well as the government sponsors, that we are greatly increasing our understanding of accident environments."

Karen Rogers, senior manager for Sandia's validation and qualification team, oversees the group that designed and conducted the rocket-sled test. Karen praised the seamless collaboration between teams, saying, "We worked in partnership, and at times side-by-side, to create all the elements that led to this successful test. It was gratifying to see the results of that hard work and the teamwork that made it happen."

### Deadline met despite pandemic

Before the COVID-19 pandemic started to impact many Sandia operations in early March, activities were on track for the summer test, Daniel said. Threat of the virus understandably complicated work

across the program, but the team came together to keep things moving forward toward the test.

"There was a feeling of, 'What are the impacts of the pandemic on this test — and can we really do this?'" he said. "Even though the unexpected challenge of COVID-19 added significant complications to an already-complex test, the crash was executed on the precise day it was planned before the pandemic, with no delay."

Because completing the test on time was critical to NNSA, much of the team continued working on site when about 70% of Labs employees started telecommuting in mid-March.

Sandia industrial health and Environment, Safety & Health professionals helped the team work effectively in close quarters by requiring masks, checking ventilation systems and advising on how to take turns inside the vehicle, Gary said. The team's procedures set a standard for social distancing at the Labs.

"Years of effort from the entire team and our partners, punctuated by the final push in a COVID-impacted world, resulted in a successful test," Daniel said. "We are delighted by and grateful for the effort of so many that led to such spectacular results." 

## Benefits Open Enrollment begins soon

Open Enrollment is your annual opportunity to review and update benefit elections for 2021. The dates for this year's open enrollment are:

- Employees: Oct. 26-Nov. 13
- Pre-Medicare retirees: Oct. 15-Nov. 13
- Medicare retirees: Oct. 15-Dec. 7

This year, Sandia will host a virtual, on-demand Open Enrollment benefits fair where you can watch an engaging video to receive Virgin Pulse points for your [Health Reimbursement Account](#).

Starting Oct. 20, visit [hr.sandia.gov](http://hr.sandia.gov) to explore what's new in the downloadable 2021 Open Enrollment newsletter. You will find everything you need for Open Enrollment at [hr.sandia.gov](http://hr.sandia.gov). There you'll have access to information about your benefits and links to HR Self Service to view your benefit choices and enroll, see your options if you're considering retirement and more. 



## Hispanic Heritage Month

"Be Proud of your Past and Embrace your Future"

The Hispanic Heritage Month Planning Committee and the Hispanic Outreach for Leadership and Awareness Employee Resource Group invite you to view our virtual celebration of Hispanic Heritage Month.

Employees can search for HOLA on Inside Sandia to access links to the events below.



- Welcome message from our VIPs: Sandia Associate Labs Director and HOLA sponsor Scott Aeilts, Corinne Sisneros (NNSA Sandia Field Office) and Col. Miller (Kirtland Air Force Base)
- National anthem, performed by current and retired Sandians
- Profiles of Sandia Hispanic Engineering National Achievement Award past winners
- Youth STEM Art Program presentation
- Hispanic Heritage Month Libro de Recetas/Dichos/Remedios Caseros (Cookbook of Recipes/Sayings/Remedies)
- Sandian art display presentation
- KAFB guest speaker: Robert Torres
- Employee Resource Group information and more
- Drive-by Car Show photos
- Historia de Nuestros Antepasados (Our ancestors' history)
- Flamenco and Mariachi History
- Closing statement: Reno Sanchez, HOLA chair

# NNSA Administrator visits Sandia's California campus



**HIGH PRAISE** — NNSA Administrator and DOE Under Secretary for Nuclear Security Lisa E. Gordon-Hagerty, left, met with Deputy Labs Director Dori Ellis during a visit to Sandia's California campus on Sept. 30. Gordon-Hagerty commended Sandia for accomplishments in recent months, including work on the Labs' nuclear security mission and response to the COVID-19 pandemic. **Photo by Florencia Prada**



**TESTING INVESTMENT** — NNSA Administrator Lisa E. Gordon-Hagerty, center, received a tour of the new Sandia Programs Engineering and Assembly Research facility at the Livermore campus during her visit. The SPEAR facility expands the Labs' capacity for assembly and electrical testing of nuclear weapons modernization program components and systems. **Photo by Randy Wong**



**PANDEMIC RESPONSE** — NNSA Administrator Lisa E. Gordon-Hagerty, left, received an update on Sandia's response to the COVID-19 pandemic from biologist Brooke Harmon during her Sept. 30 visit to the Labs' California campus. **Photo by Florencia Prada**

## Mileposts



Ted Simmons 45



Steve Lautenschleger 40



Ken Eras 30



Brad Lackey 15

## SANDIA CLASSIFIED ADS

**Note: The classified ad deadline for the Oct. 16 Lab News is noon Friday, Oct. 23. Also, please note that the deadline for the Nov. 6 Lab News will be noon Wednesday, Oct. 21.**

### AD SUBMISSION GUIDELINES

**AD SUBMISSION DEADLINE:** Friday noon before the week of publication unless changed by holiday.

Questions to Michelle Fleming at 505-844-4902.

Submit by one of the following methods:

- **EMAIL:** Michelle Fleming (classads@sandia.gov)
- **FAX:** 505-844-0645
- **MAIL:** MS1468 (Dept. 3651)

• **INTERNAL WEB:** Click on the News tab at the top of the TechWeb homepage to visit the News Center, then select Announcements >> Submit Announcement.

*Due to space constraints, ads will be printed on a first-come, first-served basis.*

### MISCELLANEOUS

**SNOW THROWER AT-TACHMENT,** TwinPro, \$650, excellent condition, East Mountains. Willmas, djwillmas@gmail.com.

**DRAIN PIPE,** 10-ft. long, white PVC, square, 4-in., \$5 ea. Lewis, 505-323-7268.

**ADCOM 2-CHANNEL STEREO,** Preamp, GFP-555II, \$25; Poweramp, GFA-545, \$25. Gelet, djgabq@msn.com.

**DESK,** 2 dressers, white, quality wood construction, perfect for girl's princess room, \$350 OBO. Malcomb, 505-400-9029.

**WHEELS,** for 4Runner, brand new, set of 4, \$300; Delta professional wood lathe, \$500; new wrought iron gate, 16-ft. wide w/posts, \$1,000. Mihalik, 505-816-8469.

**DEC PDP 11/03, PDP 11/23 & RX01 Plus,** in medium cab, free. Sypteras, 978-257-2224.

**LAWN MOWERS:** Murray 21-in., gas, rear bagger/mulcher, \$40; Great States, 14-in. push reel, \$20. Cancilla, 505-228-9640.

**ABOVE-GROUND SWIMMING POOL,** Intex, model B, 18-ft. diameter, 52-in. high, pump, filter, ladder, \$1,150. Loubriel, gmloubr@gmail.com.

**WASHER & DRYER,** Whirlpool, \$100 ea. Dennett, 505-379-9971.

**BOOKCASE, TEMA,** Scanbirk, cherry finish, adjustable shelves, 37" x 84" x 13", perfect condition, photos available, \$95. Eckelmeyer, 505-288-9966, keckelmeyer@comcast.net.

**ENTERTAINMENT SYSTEMS/ARMOIRE,** Amish Connection, solid oak, very good condition, call for photos/details, \$175. Hartwigsen, 505-459-1540.

### TRANSPORTATION

'46 JEEP CJ2A; 1944 Farmall tractor (parade winner); 2006 Dodge Cummins w/27-ft. 5th wheel. Clark, 505-469-1937, leave message.

'97 TOYOTA 4RUNNER, LTD, 4-dr., good mechanical condition, minor aesthetic issues, 212K miles, \$3,500 (KBB) OBO. Miles, 505-433-1561.

### WANTED

**VOLUNTEERS,** want to help cats? Fabulous Felines charity, fabulousfelines.org. Stubblefield, 505-263-3468.

### AD RULES

1. Limit 18 words, including last name and home phone (web or email address counts as two or three words, depending on length).
2. Include organization and full name with ad submission.
3. Submit ad in writing. No phone-ins.
4. Type or print ad legibly; use accepted abbreviations.
5. One ad per issue.
6. The same ad may not run more than twice.
7. No "for rent" ads except for employees on temporary assignment.
8. No commercial ads.
9. For active Sandia members of the workforce and retired Sandians only.
10. Housing listed for sale is available without regard to race, creed, color or national origin.
11. Work wanted ads are limited to student-aged children of employees.
12. We reserve the right not to publish any ad that may be considered offensive or in poor taste.

# 50 million artificial neurons to facilitate machine-learning research

*Research success may bring together a billion of them*



**INNER WORKINGS** — Sandia researcher Darby Smith examines the new neuromorphic system from Intel Corp.

Photo by Regina Valenzuela

By **Neal Singer**

**F**ifty million artificial neurons — a number roughly equivalent to the brain of a small mammal — were delivered from Portland, Oregon-based Intel Corp. to Sandia in September, said Sandia project leader Craig Vineyard.

The neurons will be assembled to advance a relatively new kind of computing, called neuromorphic, based on the principles of the human brain. Its artificial components pass information in a manner similar to the action of living neurons, electrically pulsing only when a synapse in a complex circuit has absorbed enough charge to produce an electrical spike.

“With a neuromorphic computer of this scale,” Craig said, “we have a new tool to understand how brain-based computers are able to do impressive feats that we cannot currently do with ordinary computers.”

Improved algorithms and computer circuitry will create wider applications for neuromorphic computers, he said.

“This very large neural computer will let us test how brain-inspired processors use information at increasingly realistic scales as they come to actually approximate the computing power of brains,” said John Wagner, Sandia manager of cognitive and emerging computing. “We expect to see new capabilities emerge as we use more and more neurons to solve a problem — just like happens in nature.”

“The shipment is the first in a three-year series of collaborator test beds that will house increasingly sophisticated neural computers,” said Scott Collis, director of Sandia’s computing research center. “If research efforts prove successful, the total number of experimental neurons in the final system could reach one billion or more.”

“As high demand and evolving workloads become increasingly important for our national security, Intel’s collaboration with Sandia will provide the tools to successfully scale neuromorphic computing solutions to an unprecedented level,” said Mike Davies, director of Intel’s Neuromorphic Computing Lab. “Sandia’s initial work will lay the foundation for the later phase of our collaboration, which will include prototyping the software, algorithms and architectures in support of next-generation, large-scale, neuromorphic research systems.”

Machine-learning achievements, of which neuromorphic computing plays a part, already include using neural circuits to make critical decisions for self-driving cars, classifying vapors and aerosols in airports and identifying an individual’s face out of a mass of random images. But experts in the field think such capabilities are only a start in improving machine learning in more complex fields, like remote sensing and intelligence analysis.

“We have been surprised that neural computers are not only good at processing images and data streams. There is growing evidence that they excel at computational physics simulations and other numerical algorithms,” John said.

Sandia artificial intelligence researcher Brad Aimone said, “In terms of neural-inspired computing uses, we are still in the infancy of the explosion to come.”

## Explosion of uses

Intel, a commercial computer chipmaker, and Sandia, a national security lab, aim to explore the effects of increased scale on the burgeoning field of artificial intelligence in commercial and defense areas, respectively.

For both areas, “what’s still to be determined are the extent of problems that can be solved by AI and the best algorithm and architectures to use to solve them,” Craig said. “We can now build these systems at scale, but which algorithms and architectures would best capitalize on the fabrication advances are unknown.”

Modeled on the complex linking of neurons in the human brain, neuromorphic computers eventually may use far less electrical power and weigh much less than today’s personal computers.

Computers with artificial neurons act through mathematical approximations, rather than forcing a problem’s solution into conventional computing paths that may contain a forest of inessential steps, Craig said.

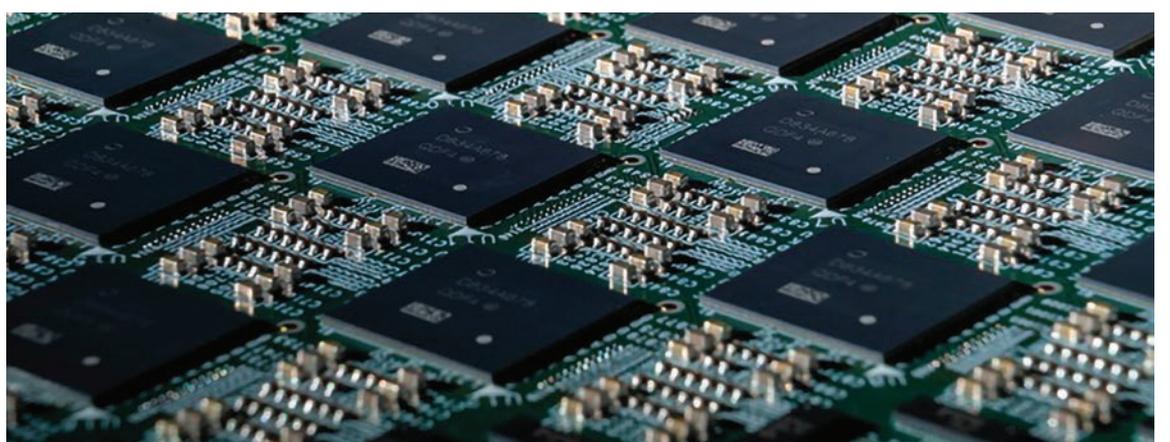
But machinery based on circuitry that involves strong electrical spikes, like the biological brain’s operation, has been delayed because “many algorithms that exist today are based upon developers making efficient use of mainstream computer architectures,” he said. “But brains operate differently, more like the interconnected graphs of airline routes, than any yes-no electronic circuit typically used in computing. So, a lot of brain-like algorithms struggle because current computers aren’t designed to execute them.”

## Neural algorithms hum along

An additional aim for Craig and colleagues, who already have small prototypes of two and eight chips in Intel’s most advanced class of neuron sets, called Loihi, is to add enough neurons that algorithms based on brain-like logic can be employed on brain-like computer architectures.

By using emerging brain-inspired architectures to do research and development, “we’ll be providing new approaches and abilities from which novel algorithms can emerge,” Craig said.

The work is funded by NNSA’s Advanced Simulation and Computing program. 



**COMPLEX CIRCUIT** — Boards containing artificial neurons will serve as the foundation of a multiyear collaboration between Sandia and Intel Corp. on neuromorphic computing.

Image courtesy of Intel Corp.