Successful crash test meets major milestone for nuclear deterrence program

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

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 Sandia manager Barry Boughton was part of the team that worked on the previous fleet of semitrailer 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.’”

Starting ‘with a clean sheet of paper’

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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.

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 Latter
Herrera appointed to national quantum computing advisory committee
By Troy Rummeler

Sandia 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 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.

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

Photo by Randy Montoya
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 UWCMN 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.

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 1,375 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, UWCMN’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.

“Together Apart 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.”

Mission support

The UWCMN 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.
By Kristen Meub

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 power 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 premier, 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 STEIM professionals: have passion 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 defense innovation 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 to him to turn his dedication towards assuring that all of the scientific and analytical expertise that this generation has developed will remain available to the future that follows,” Rod said.

Eventually, the U.S. will solve its nuclear waste problem. It cannot be known whether or not the world will 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 her high school and 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 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 at Sandia 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 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 and give you a different opportunity.”

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 awareness presentations into both internal and external 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 30+ years at Sandia,” said Josey 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.

“Sheshe 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 cyber-security 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.

FUELING INNOVATION — Evarnisto “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.

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 Sanita employees have been recognized at HENAAC since 1994.

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

Bonano and Rivas earn HENAAC recognition

By Kristen Meub

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

Evarnisto “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.

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
Machine-learning technique could improve fusion energy outputs
Building a better reactor by modifying its walls

By Neal Singer

Machine-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 to accommodate 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.

“Modeling nuclear fusion by 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 labious.

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 Kolasiński, Mitchell Wood, Julien Tranchida, Khachik Sargsyan, and Mary Alice Casentino.

Safety class is still in session

By Karl Massey

Even 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 courses 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.
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 multiorganization 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 acquisition 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 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 intense. 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 what’s new in the downloadable 2021 Open Enrollment newsletter. You will find everything you need for Open Enrollment at 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.

OVERCOMING CHALLENGES — Sandia quality engineer Dolce 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 courtesy of Sandia National Laboratories

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

Welcome message from our VIPs: Sandia Associate Labs Director and HOLA sponsor Scott Aerts, Cornelia Staneva (RNHA Sandia Field Office) and Oci. Miller (Khartoum Air Forces 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 Recuerdos/Echos/Remembrances Celebrations (Cookbook of Recuerdos/Beings/Remembrances)

Sandian art display presentation

Hispanic Heritage Month Lunar Lander/Desierto/Echoes/Remembrances (Robots/Space/Desert)

Closing statement: Pana 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 Doris 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

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.

Submit by one of the following methods:
• EMAIL: Michelle Fleming (classads@sandia.gov)
• FAX: 505-844-0645
• MAIL: MS1468 (Dept. 3651)

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.
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 student-aged children of employees.
8. No commercial ads.
9. For active Sandia members of the workforce and retired Sandians only.
10. Housing listed for sale is available with ad submission. No phone-ins.
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.

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.

MISCELLANEOUS
SNOW THROWER AT-TACHMENT, Troy-Bilt, $800; excellent condition, East Mountains. Willmar, djwilmas@gmail.com.
DRAIN PIPE, 10-½, long, white PVC, square, 4-in., $5 ea. Lewis, 505-323-7268.
ADCOM 2-CHANNEL STEREO, Pump, GFPS-555L, $25; Pioneeramp, GF-455, $25; Gakken, djgabq@msn.com.
DESK, 2 dressers, white, professional wood lathe, new, set of 4, $300; Delta STEREO, Preamp, GFM-545, $25. Gelet, gmloubr@gmail.com.
LAWN MOWERS: Murray 21-in., gas, near burger machine, $40; Great States, 14-m. push-reel, $250; Can- cilla, 505-528-9640.
ABOVE-GROUND SWIMMING POOL, Inners, round B, 16-ft. diameter, 52-in. high, pump, filter, ladder, $1,350. Loubriel, gmsbbn@gmail.com.
STEREO, 21-in., elect., $350 OBO. Malcomb, 505-379-9971.
LAWN MOWERS: Murray '97 TOYOTA 4RUNNER, '46 JEEP CJ2A; 1944 Farmall TRANSPORTATION, LTD, 4-dr., good me- chanical condition, minor aesthetic issues, 212K miles, $3,500 (KBB) OBO. Miles, 505-469-1937, leave message.
ENTERTAINMENT SYSTEMS/ARMARE, Amish Construction, solid oak, very good condition, call for photos/details, LT7, Harbinger, 505-459-1540.
SPEAR facility expands the Labs’ capacity for assembly and electrical testing of nuclear weapons modernization program components and systems. Photo by Randy Wong

Ted Simmons 45 Steve Lautenschleger 40 Ken Eras 30 Brad Lackey 15
50 million artificial neurons to facilitate machine-learning research
Research success may bring together a billion of them

By Neal Singer

Fifty 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 pulsed 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 artificial intelligence research.

“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 Aimeone 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 can emerge,” Craig said.

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.

Photo by Regina Valenzuela

Image courtesy of Intel Corp.