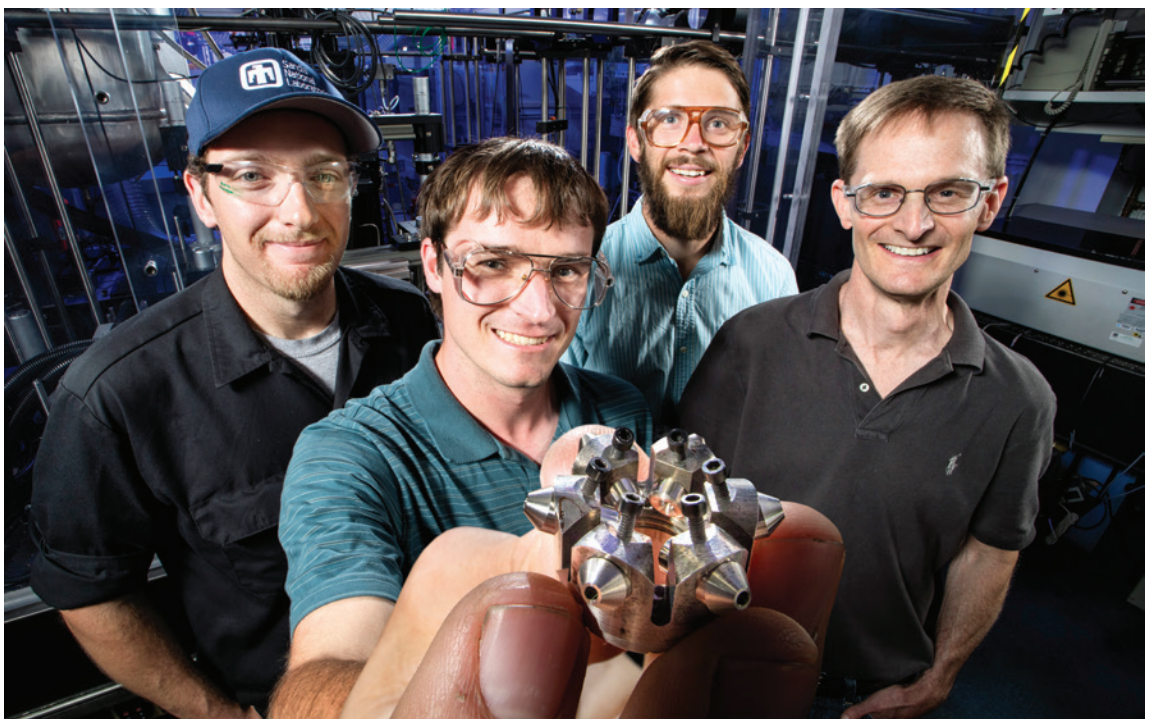
SANDIA LABNEWS
PUBLISHED SINCE 1949

Vol. 71, No. 17, August 30, 2019

Kilimanjaro: Together at the top PAGE 8

California & Beyond Edition



DFI GUYS — From left, Nathan Harry, Christopher Nilsen, Drummond Biles and Chuck Mueller show off the prototype ducted fuel injection module. **Photo by Randy Wong**

Andy McIlroy was announced Wednesday as the Associate Labs Director for Integrated Security Solutions

Diesel engine revolution

Ducted fuel injection promises cleaner combustion

By ***Michael Ellis Langley***

An engine innovation first conceived and tested by Sandia scientists has attracted the attention of big business because it synergizes with renewable fuels and takes almost all the soot out of a diesel engine's exhaust without sacrificing performance or increasing cost.

Ducted fuel injection, developed by Chuck Mueller at Sandia's Combustion Research Facility, is able to fine-tune the amount of diesel used in an engine to the point of eliminating between 50 and 100% of the soot.

The birth of ducted fuel injection

DFI was first conceived by Chuck from — of all things — a Bunsen burner like those found in almost every high school science classroom in the nation.

"If you unscrew the tube on a Bunsen burner and you light the gas jet, you get a tall sooty orange flame," Chuck said. "Turn off the gas, screw the tube on and re-light the burner. Now you get a nice, short blue flame right at the end of the tube. The flame is blue because there isn't any soot."

Chuck thought that concept might be adaptable to combustion engines, so he and his team, Christopher Nilsen, Drummond Biles and Nathan Harry, began experiments that have now resulted in an assembly of four to six small tubes, or ducts, directing fuel mixture from the injector right to the points of ignition.

Chuck said that injectors in a traditional diesel engine create local mixtures containing 3-10 times more fuel than is needed for complete combustion.

"When you have that much excess fuel at high temperature, you tend to produce a lot of soot," he said. "Installing the ducts enables us to closely approach what we call 'leaner lifted-flame combustion' — diesel combustion that doesn't form soot — because the local mixtures contain less excess fuel."

That keeps the vast majority of the soot produced by traditional diesel engines from even forming.

Emissions balancing act

Generations of engine designs have failed to take soot out of emissions because there was a physical limit to the chemistry of fuel combustion.

"Soot is second only to carbon dioxide in climate change, and it's toxic, so its emissions should be minimized," Chuck said. "In the past, there's always been this problem called the soot/nitrogen oxides trade-off. That is: when you do something to lower soot, emissions of nitrogen oxides — or NO_x — go up, and vice versa."

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Getting to the nuts and bolts of nuts and bolts

New computer modeling method may cut weeks off research time

By ***Michael Ellis Langley***

After more than five years, a mathematical breakthrough devised by a structural engineer and computational scientist may save Sandia time and resources to test complex systems.

The problem with multiple scales

Mechanical engineer Alejandro Mota began working on trying to reduce the time it takes to computer-model systems of numerous large and small components with the same amount of fidelity and detail.

"If you want the smallest components, like the nuts and bolts, and everything else in very high resolution, it would be computationally prohibitive," Alejandro said. "It would take so long — with the same level of detail in all the small parts — that it would be essentially useless."

Sandia tests and produces a variety of weapons systems, and the ability to test every component independently and in concert with one another is vital.

"Models are really hard to build when there are different scales involved — that is, when you have an object that has really small pieces together with large pieces," said computational scientist Irina Tezaur, who started working with Alejandro in 2015. "If you use the smallest scale everywhere to ensure that your simulation is able to resolve everything, you will end up with really a crazy amount of computations."

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LABNEWS Notes

MY SANDIA STORY

Keeping sight of our mission

By **Curt Nilsen**

FINDING THE 'WHY' — Senior manager Curt Nilsen holds a framed photograph showing a Nazi commander officially surrendering to the Norwegian Resistance at the end of World War II. Curt's grandfather was part of the resistance efforts. **Photo by Rebecca Gustaf**

"Sandia develops advanced technologies to ensure global peace." We all know Sandia's mission statement. But do we regularly pause to reflect on its importance and our role in seeing it realized?

In my experience, it can be easy to get so wrapped up in the day-to-day details of our work that we lose sight of the real reason we are at Sandia. We find ourselves worrying about the agenda for an upcoming meeting, a phone call we need to make or an email we need to send. But do we regularly operate out of a deeper sense of purpose?

In one of the programs I worked in several years ago, there was a lieutenant colonel with the Air Force who would often start program review meetings with the 'Big Picture.' Before we got into the agenda, he would lead a discussion of the value of the nuclear stockpile and the nation's deterrence mission.

In one particularly memorable case, he discussed tensions in the Middle East involving U.S. and Russian military forces. He noted that a strong, credible U.S. deterrent had helped keep that tension from escalating further. The way this officer centered his team on the 'why' has always stayed with me.

Inspiring my 'why'

On a personal level, my family history serves as a reminder and a personal inspiration. My father grew up on a small island off the coast of Bergen, Norway, during the Nazi occupation of World War II. My grandfather even did some limited work for the Norwegian Resistance, the "Underground," during the war.

From 1945 until the day he died, my grandfather prominently displayed in his home a framed photograph of the Nazi commander officially surrendering to the Norwegian Resistance at the end of the war. I keep a copy in my office as a reminder that just one generation ago, my family lived under tyranny. The photo also serves as a reminder that American involvement in World War II played a key role in removing the curse of Nazism from Norway and the rest of Europe.

Even though I grew up in relative peace and don't have first-hand experience with the perils of war, I'm reminded that evil is still afoot in this world, and that the work we do at Sandia plays an important role in dissuading our adversaries from more aggressive action.

Significant global impacts

One of the most profoundly satisfying parts of working at Sandia is the opportunity to be involved in work that really matters. Every day, Sandians work on science, engineering and technology that makes major contributions to our national security and helps uphold the values we hold dear as Americans. The impact of our work is felt around the globe.

Sandia's work to maintain the nuclear stockpile, keeping it safe, secure and reliable, can't be understated. Deterrence plays a vital role in helping prevent violent acts against the United States and our allies. People around the world rest easier because of the assurance that the nation's stockpile provides.

Certainly, it's not only our weapons programs that make significant impacts. Sandia's work in cybersecurity protects from enemies hacking into vital computer systems, our work in the energy sector makes our future more sustainable and our work in chemical, biological, radiological and nuclear defense takes active measures to protect our nation from terrorism. At every turn, we are doing very compelling work, and we can't lose track of the service we provide the nation.

There is value in periodically taking a step back to remember and honor our mission. As an organization, as work teams and as individuals, we must find ways to tie the everyday tasks and projects we manage to the greater vision of what we are achieving. When our "why" becomes more deeply ingrained in our daily work, we will find greater fulfillment and solve even greater challenges that face our nation.

SANDIA LABNEWS
PUBLISHED SINCE 1949

Managed by NTESS LLC for the National Nuclear Security Administration

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Classified Ads 505-844-4902

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

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

LAB NEWS ONLINE: sandia.gov/LabNews

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.

California & Beyond Lab News staff

CA & BEYOND LAB NEWS STAFF — From left, Rich Ellenson, Michael Padilla, Paul Rhien and Michael Ellis Langley (**Photo by George Su**). Inset, Sarah Jewel Johnson.

Help wanted: People with passion for national security

Integrated Security Solutions close to meeting staffing goals

By ***Michael Padilla***

TOUR DE FORCE — Mike Oberti, right, who serves as the new hire success champion, leads a group of new employees as they walk to Building 911, where telemetry work is conducted. **Photo by Dino Vournas**

Interesting and fun. That is how Jennifer Clark, senior manager of the telemetry and handling gear engineering group, describes the work conducted at Sandia/California when recruiting prospective Sandia engineers.

"During interviews, we highlight the work-life balance at Sandia, as well as the national security impacts of the job," Jennifer said. "We also emphasize that we consider our specific work to be really interesting and fun."

Jennifer is the Integrated Security Solutions director designee for electrical and mechanical lab and division-wide hiring teams. Jennifer is responsible for ensuring that staffing needs are met throughout the division. She, along with Mike Oberti, who serves as the new-hire success champion, works closely with Sandia recruiters, hiring managers and human resources.

Mike said his primary goal as the new hire success champion for Integrated Security Solutions is to help implement processes where new-hires can feel welcome to reach out with questions and ideas to help make their integration into Sandia as smooth as possible. He currently is assisting nearly 200 new hires and employees without security clearances.

"I view this role as the catalyst to enable positive systematic change by creating relationships and partnering with people that will enable sustainable and empathic solutions," Mike said. "Our vision is to empower a community of Sandians that fosters a sense of belonging, enabling each person to reach their highest potential."

Mike said he is grateful that he works with an extraordinary group of people.

"I want to make sure that new hires have the best experience possible to provide exceptional service in the national interest," Mike said, adding that he is using a systems engineering approach to develop holistic, empathic solutions to create a great experience and a sense of belonging for new hires.

On track to meet hiring goals

Associate Labs Director Andy McIlroy said the division is on track to meet its projected hiring goals for fiscal year 2019. The division is at 98% of the hiring target. As of Aug. 8, there are 278 non-student new hires for the fiscal year, including 32 with future start dates.

"People are our greatest resource," Andy said, adding that hiring the best people helps ensure that we meet all of our goals. "We are fortunate that we have such a dedicated workforce in California and New Mexico." He said he is very optimistic for the upcoming fiscal year and is grateful for all the hard work to fulfill the division's staffing needs.

"It truly takes an army of people to hire new team members," he added. "Everyone has really stepped up in helping out with all the hiring throughout the year."

"Bringing people into the Labs is everyone's business," said Traci Ryan, a human resources manager for Sandia/California. "Whether you are part of an interview panel or volunteer as a buddy for a new hire, everyone plays a role. We are all invested in the success of the division."

CYBER TALK — Clockwise from bottom left, Cyber systems research manager Donna Djordjevich-Reyna talks to recent Sandia hires Michael Symonds, Sophie Quynn, Michael Carson and Chris Harrell. **Photo by Michael Padilla**

Traci noted that the Integrated Security Solutions talent acquisition team model has shifted in the past couple years to meet the division's increased hiring needs. This shift includes centers having designated staffing partners and the addition of recruiters that source hard to find candidates.

"We realize it's a war for talent and have continued the practice of candidate briefings to create a high touch candidate experience," Traci said. "With the W80-4 and W87-1 as two of the biggest drivers for hiring needs, conversations with candidates focusing on Sandia's employee value proposition, which includes mission, work, people and culture, is key. Overall, we want folks to know Sandia is a great place to work."

Developing a rhythm for hiring

"We have developed a really good rhythm for how we deal with our postings, review resumes and set up and conduct interviews," Jennifer said, adding that Integrated Security Solutions, in conjunction with a corporate-level hiring initiative, has created a working group. The group makes specific corporate and division-specific job postings.

The working group has access to an expanded set of resumes, and whenever any member of the group brings in a candidate, the entire working group is notified and invited to participate. This gives hiring managers access to more job applicants and exposes the interview candidate to a broader introduction to Sandia/California and the different types of work at the site. The result is a better alignment between candidates' desires and hiring managers' needs.

Energy and earth systems director Carol Adkins said the jobs that Sandia offers candidates in the energy program is challenging work on the nation's hardest problems, and offers the opportunity to work with experts, both internal to Sandia and internationally, across all energy fields.

Carol said hiring for New Mexico has its own challenges — different from California, but not easier — adding that there is often a struggle hiring for the Carlsbad, New Mexico, work supporting the Waste Isolation Pilot Project.

"Southeastern New Mexico is lovely, but somewhat isolated," Carol said. "It's also an oil and gas boomtown. New Mexico is also a lovely place to live."

For the work supporting Sandia's energy program, staffing specialist Jodi Butler has taken additional steps to recruit electrical engineers with power systems expertise. That field is "hot" right now, due to the focus on energy and the nation's grid. Jodi said staffing specialists use advertising, university contacts, recruiting tools and other resources that are specifically brought up when strategizing about individual postings in order to meet year-end goals.

Jeff Gebel, acting energy and homeland security director, credits the strong efforts of both Sandia recruiters from the line and targeted recruiters within human resources.

"The division has benefited greatly from the HR targeted recruiters, as they have been able to find experienced candidates with critical skills, all while taking a lot of the initial burden off of the managers," Jeff said. "A few years ago, HR started pairing targeted recruiters with some of our hardest to fill positions. It's been a great success overall."

Maintaining a healthy pipeline, diversifying the candidate pool

Enterprise cybersecurity manager Gio Kao's key recruiting message — in addition to emphasizing Sandia's national security mission — is Sandia's commitment to a great work-life balance.

"We offer a very flexible work schedule," he said. "The 9/80 and 4/10 schedules are well received."

Gio knows the challenges faced when recruiting for new employees.

"Cybersecurity is one of the fastest changing fields in government and industry," he said. "We are in a very competitive job market, and we need to be creative in recruiting and retaining top talents. Our goal is to maintain a healthy pipeline and diversify our candidate pool."

New recruiting ideas have been working well for Gio and his team when searching for candidates for Sandia/California's Center for Cyber Defenders internship program.

In the past year, Gio's group has implemented on-campus recruitment strategies for candidates that are historically more difficult to recruit, such as women and minorities.

"We have participated in various local and national events organized by the Society of Women Engineers, Women in Cybersecurity and National Society for Black Engineers," he said.

Sandia representatives also reach out to cyber and computer science focused student organizations, such as the CyberCorps Scholarship for Service program.

Gio advises recruiters and other Sandia managers to start early in the recruiting season and to stay in touch with potential candidates even if graduation is a few years away. He said that it's important to build relationships and establish research partnerships with professors who may recommend students to Sandia positions. Above all else, he stresses that managers should make job offers quickly to potential employees.

California campus changes ahead

SANDIA/CALIFORNIA — Aerial view of Sandia's Livermore, California, campus. **Photo by Randy Wong**

Office and lab space reconsidered as staff, mission expand

By ***Michael Ellis Langley***

It is easy to see that the Sandia/California campus is in a state of evolution. An unprecedented spate of hiring to achieve mission goals means the space at the Livermore campus must be reevaluated with an eye to the future.

As staffing increases, planners and managers must confront the physical limits of offices and lab space, sewage and electrical capacity and demand for digital infrastructure that are inherent in the current site layout.

"The rate at which new people are coming onboard is far more than in years past," said manager Devon Powers, "so we have to make changes throughout the site to accommodate everyone responsible with making sure we are successful in our mission."

Using the cooperation being modeled by Sandia's Integrated Service Delivery initiative, the California site operations and energy and homeland security programs came together to help figure out how best to answer the challenges of change.

Office space reevaluation

Devon said that Sandia/California plans to add hundreds more employees in the coming years, which means preparing for them now.

In some existing buildings, this may mean shared spaces and upgrading electrical, heating and cooling and network infrastructures.

"There's a lot of support that we have to provide to add more people to any space," Devon said. "It's not just adding desks to offices. We want to keep all the functionality and create workflow efficiencies where we can."

Devon added that the boundaries of Livermore's restricted zone, including which buildings fall inside that zone, may change as well.

"We're taking best advantage of the footprint that already exists," he said. "So that the classified work that we do on behalf of the American people can continue with as little interruption as possible."

Devon also pointed out that senior management is looking into leasing off-site property — perhaps as early as next year — and trying to figure out which functions could be temporarily located there to free up space while the campus is expanded.

"We are in the planning stages of adding new buildings and facilities on campus," he said.

Lab space considerations

Some labs are also undergoing repurposing as the W80-4 work is renewed and as teams are forming to work on the W87-1 weapons systems.

"We have to use our specialized facilities strategically," Devon said. "In order to do that, we've put together a very aggressive and comprehensive program to look critically at lab space. We know this is going to be disruptive for some of our research programs.

"Our goal is to get all of our teams what they need with the space we have available," he said. "As we are able to build out and grow, we will continue to partner with the technical line to ensure they have what they need to execute Sandia's critical national security mission."

Investing in infrastructure

Expansion seems to be on the horizon.

"We are getting strong support for our infrastructure from NNSA," Devon said. "They have invested in a new sewer system and in water and power infrastructure. We are getting a new data center, and there are plans for other buildings on campus down the line."

The funding for some of that is already secured for the next couple of years.

Devon said that despite the temporary inconveniences of relocation, construction or sharing space, teams from every group are working together to develop integrated solutions that will enable Sandia/California to achieve all of its objectives.

"Our country's asking us to do a lot, and we're responding and doing what it takes to make best use of the existing campus that we have as we plan for the future," Devon said. "We will get through the temporary disruptions the same way that we have achieved so much already — together."

Sandia helps Puerto Rico grid resilience

By ***Sarah Jewel Johnson***
Photos by ***Robert Broderick***

The days and weeks following a natural disaster are a critical time for residents, emergency response teams and government entities to recover and rebuild infrastructure. Recovery can be time consuming, and rebuilding after disaster presents a critical juncture that requires methodical planning; however, few communities rebuild with resilience in mind.

Sandia's microgrid team hopes to change that.

A microgrid is electrical infrastructure that uses a system of power generation and automatic control to link buildings and other assets in a designated area, ensuring access to electricity for these buildings even if the power grid goes down. Sandia refers to these groups of microgrid buildings as resilience nodes because they assure access to essential services and allow for response and recovery after electric grid disruptions.

Island and rural communities present a unique opportunity for resilience research and development. Sandia, along with various partners, has developed a microgrid resilience modeling tool to help identify critical infrastructures in isolated and island communities.

The Sandia-developed Microgrid Design Toolkit characterizes the trade-space and provides what-if analysis of design choices to provide quantitative insights to decision makers for hybrid energy solutions. Using the MDT tool, utilities or other community stakeholders, such as universities, can identify vulnerabilities in infrastructure particularly susceptible to natural disasters and related consequences. Cities and communities can then use the model to inform future building, policies and emergency response plans.

The MDT couples an advanced design-level optimization search algorithm with a microgrid sizing capability that determines the cost versus load payment on all proposed microgrid placements. Using these algorithms and models, researchers can identify a net present value for day-to-day microgrid load to eventually reach a profitable outcome.

Puerto Rico, phase one

After Hurricane Maria in September 2017, Puerto Rican dependence on local electric supply prompted DOE-funded research on grid modernization and improvement. As part of this research, Sandia worked alongside the Puerto Rico Industrial Development Corporation to deploy six microgrid demo sites across the island.

These sites were intended to generate power to key infrastructure buildings, such as hospitals, during a time when the Puerto Rican Emergency Relief Administration could not address all critical power needs on the island. The demo sites were also used to develop replicable microgrids intended for use across the island and eventually in other rural, isolated communities.

In addition to the focus on rebuilding resilient infrastructure, the research team was faced with the additional burden of presenting a resilience plan that could be stood up in a condensed timeframe to assure residents have access to critical resources. The first phase of Puerto Rico resilience work focused on identifying opportunities to understand the community and critical infrastructure and ways to reduce societal burden.

Sandia researcher Bobby Jeffers said societal burden is, "how hard people have to work to get critical infrastructure needs satisfied. It is determined by level of effort required for people to satisfy their needs, divided by their overall ability.

"The higher the effort and lower the ability, the greater the societal burden," he said. Societal burden metrics can include shelter, food, water or other critical needs, and can be quantified by city zone, district, census block or general geographic region.

Results from this multi-lab collaborative discussion informed a federal report to Congress to justify application for Federal Emergency Management Agency funding in 2018.

SWITCH REVIEW — Sandia employees inspect a bank of switchgear, which are used to monitor, control and protect different power assets that make up a microgrid.

PUERTO RICO POWER — The above photo shows an example of a substation that will be used in a Puerto Rico microgrid.

Puerto Rico, phase two

The second phase of resilience work in Puerto Rico includes capacity building and workforce development. The phase two team is developing the Resilience Node Cluster Analysis Tool, which optimizes locations for microgrids across a large planning region focused on decreasing societal burden at least cost. Phase two also incorporates use of the quasi-static time series, which assesses the time-dependent aspects of power flow, frequency and possible impacts of photovoltaic deployment on the grid. The energy resilience team won a Sandia Employee Recognition Award for this work, particularly for their effort to "hold the grid together and keep the transmissions lines in use after disasters," manager Ray Byrne said.

The team continues to work on ReNCAT 2.0, which will incorporate additional cost variables such as blue-sky benefits. ReNCAT couples with MDT to provide a holistic cost benefit and societal burden analysis of any geographic region. Additional future work includes development of an explicit QSTS algorithm that no longer requires manual review of grid topology to automatically pinpoint opportunities for maximum community benefits and grid constraints.

In an ongoing effort to expand application of both MDT and ReNCAT, the Office of International Affairs and State Department are currently working with Sandia to identify resource sharing among other islands in the region, providing an additional energy fail-safe. Most funding is provided by DOE, with additional FEMA funding in the U.S. Virgin Islands and Puerto Rico. Through continued efforts, Sandia hopes to assure resilience is an essential reliability service, providing access to basic needs such as safety, security, communications, health and transportation in the wake of disasters.

After Hurricane Maria hit the Caribbean in 2017, DOE funded a partnership that included Sandia, FEMA and Housing and Urban Development to develop assessment tools for resilience-focused rebuilding. This effort to focus on resilience during a rebuilding period presented a paradigm shift, as most rebuilding work tended to focus only on rebuilding key infrastructure and not on rebuilding with resilience in mind.

"The rebuilding focuses on providing utility access and regulatory support as soon as possible after a disaster," said former Sandia manager Abraham Ellis. "Whereas, without the tool, some areas of Puerto Rico could be without power for six to twelve months."

Sandia's MDT tool provides a rigorous, quantitative approach to analyze macro and micro-scale

— CONTINUED ON PAGE 11

Patio posters show promise of interns' future

Posters lined the shaded areas of the GAA Event Pad on July 24 as interns showed off 36 different projects they have worked on this summer, giving oral presentations explaining their work to those who stopped by.

Carlos Casadevall showed off a system he is helping develop to create inkjet-printed organic redox transistors for neuromorphic computing — systems that mimic biological brain functions — and neural interfaces. David Johnson is working on a project to help protect the nation and the world from cyber attacks.

Adriana Del Cid, who works in the community relations area, said her internship has opened her eyes to Sandia's efforts to directly impact people in our local communities. Sydney Spruiell is working toward a career in graphic design through her internship at Sandia.

Both Sydney and Adriana said they are happy that Sandia provides opportunities for interns who are not only interested in science and engineering but a variety of different job functions. They both plan to tell their peers to seek an internship here.

SHOWING THEIR WORK — Adriana Del Cid, left, and Sydney Spruiell (both 8100) explain their internships in the communications. **Photo by Randy Wong**

Sandia/California opens doors to family, friends

Family Day 2019 set for Sept. 14 in Livermore

By ***Michael Padilla***

Family Day is a rare opportunity for Sandia/California's workforce to show family and friends the critical work conducted at the site in the interest of the nation. This year's Sandia/California event is Saturday, Sept. 14, 9 a.m.-3 p.m.

"There is a certain element of mystery and wonder about what goes on at Sandia/California," said Associate Labs Director for Integrated Security Solutions Andy McIlroy. "Family Day 2019 offers an exclusive look into the extraordinary work and culture at Sandia. We are proud of everyone who works here and their accomplishments, and we want to showcase their talents, teamwork and the special activities that take place at the Labs."

The event will feature activities, tours and demonstrations that are designed to be both fun and educational, focused on highlighting the breadth and depth of the engineering and science research at Sandia.

The event, which has been held at Sandia/California only 12 times over the event's 60-year history, has been in the planning stages for several months, thanks to a team of dedicated volunteers led by Kayla Norris, Sandia/California's community relations officer.

Kayla and the planning team hope families and guests feel comfortable and welcomed as they are introduced to the California site.

"We hope that all visitors will be inspired to share and promote Sandia's work within their own circles and communities," Kayla said. "We encourage everyone to take full advantage of this opportunity to show their guests where they spend 40-plus hours a week and how they individually contribute to the Labs' programs, mission, the nation and Sandia's overall successes."

Kayla said the site's employees spend countless hours, years and oftentimes their entire careers working to support Sandia's mission.

"Hopefully, it's a day to slow down, connect and spend quality time with family, friends and colleagues," Kayla said.

Fun for all at the event pad, throughout the site

"Sandia/California is a very tight-knit community, and it was important to have a balance of learning and activities that bring people together," said Krissy Galbraith, who helped spearhead the event planning at the GAA event pad and throughout the site. "We want to make this an event that employees can enjoy with their guests of any age by hosting a variety of interactive activities, tours and demos across all mission areas."

The event pad will be the central location for obtaining information about the day's activities. Eventgoers are encouraged to visit the information booth for a schedule and map. Sandia swag, including new custom stainless-steel water bottles to use for the day, will be available for purchase.

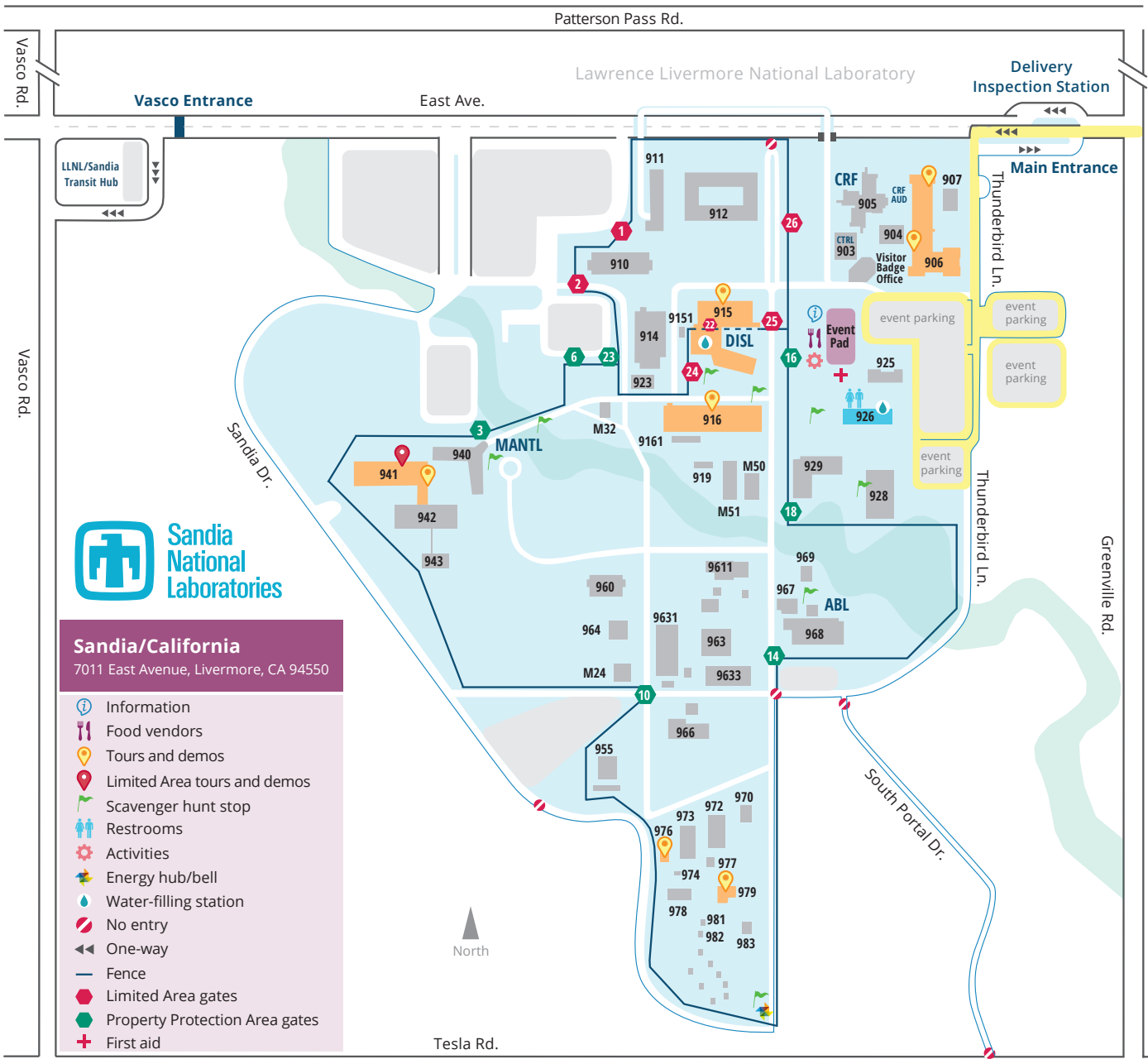
Key community partners and Sandia organizations will be at the event pad to share extended learning opportunities focused around science, technology, engineering, art and mathematics for K-12 students.

A variety of food vendors will sell healthy and sweet treats throughout the day. Food truck vendors will sell breakfast items for the morning crowd, and new trucks will roll in to offer lunch options during the afternoon hours.

Eventgoers can swing by the Snap Yourself! photo booth, which will be fully stocked with an array of props guaranteed to make families laugh out loud. After the event, high-resolution photos will be available for guests to download.

A scavenger hunt will allow friends and family to see the entire site (see map for locations).

Those interested in volunteering at the event should contact Kayla Norris. Employees can visit Sandia's internal 2019 Family Day website.



Host Guidelines

- All visitors must be registered and hosted by a Sandia employee/contractor or Sandia Field Office employee.
- The host must carry a copy of the completed registration form and accompany guests at all times.
- Hosts accompanying visitors can park in event parking lots only.
- Visitors can be escorted only to Limited Areas routinely accessed by their L- or Q-cleared hosts.
- Visitors are not allowed in Vault-Type Rooms, Sensitive Compartmented Information Facilities, and Special Access Program Facilities.

Prohibited and Controlled Items

- Alcohol or other intoxicants
- Illegal drugs and paraphernalia
- Weapons, explosives, incendiary devices, and other dangerous materials likely to produce injury or damage
- All types of tobacco
- **Not allowed in Limited Areas:** Personally owned electronic devices, including cell phones

Note: *All event participants are subject to search at any time by established authorities, including security police officers.*

https://wp.sandia.gov/familyday

1959 TELEMETRY DISPLAY — Sixty years ago, Sandia/California opened its doors to family and friends for its first Family Day event. **Photo courtesy of Lab News archive**

SALTON SEA — Sandia friends and family took part in Family Day at the Salton Sea Test Base in 1959. The base was operated by Sandia and included a field test range that covered an 83-square-mile area. The site had its own security force, fire department, medical facilities, water treatment plant, air strip, boat docks, various shops, power plants, a hotel, limited housing and a trailer park. **Photo courtesy of Lab News archive**

MICROSCOPY IN PERSPECTIVE — Ray Friddle, right, holds his two-year-old daughter, Lily, while explaining microscopic cantilevers used for atomic force microscopy during the 2012 Family Day event. **Photo by Randy Wong**

2014 FLASHBACK — Grace Beasly, right, daughter of Stephanie Beasly, compares the results of a chromatography activity with Pam Lane. That year, nearly 500 employees, along with their family members and friends, attended Family & Friends Day at Sandia/California. **Photo by Dino Vournas**

Safety and Security First

Employees who are bringing family and friends to Sandia/California's 2019 Family Day event are responsible for keeping their guests safe and secure. Below are some tips to keep in mind when planning for the event:

- Stay hydrated. Bring your own water bottle. Water-bottle-filling stations will be available in GAA and Building 926.
- Wear comfortable clothes and closed-toe shoes.
- Observe safety practices throughout the site.
- Put trash and recyclable materials in marked receptacles.
- Park in designated areas and avoid parking in front of fire hydrants.
- Report any unsafe conditions.
- Do not bring intoxicants, illegal drugs, drug paraphernalia, firearms or explosive materials.
- Leave all pets at home.
- Don't talk about classified activities or sensitive projects.
- If entering limited areas, do not bring any electronic devices, including but not limited to, cell phones, laptop computers, removable computer media, audio and visual recording devices, portable and wireless devices with transmitting capability, two-way pagers, smartwatches, Apple devices, e-readers, Fitbits or other fitness trackers and Bluetooth devices.

Together at the top

African adventure reunites former Sandia work group for journey of a lifetime

By ***Paul Rhien***
Photos courtesy of ***Doug Henson and Carole Le Gall***

After seven days traversing the rainforest, rocky cliffs and alpine desert of Tanzania, a group of current and retired Sandia employees found themselves making the final ascent of Mount Kilimanjaro last fall. They had trained and prepared nearly a year for the moment, yet nothing could have fully prepared them for the deep sense of accomplishment and satisfaction of reaching the summit of the world's tallest free-standing mountain.

"Standing atop Kilimanjaro, I felt lots of gratitude to have been fortunate enough to set off on this adventure," said Carole Le Gall.

After congratulating each other with high-fives and taking some quick photographs, the team didn't stay long atop Uhuru Peak at 19,341 ft. above sea level, as they were met with strong winds and icy conditions. But the moment atop the "Wonder of Africa" was one they won't soon forget.

"It was really a trip of a lifetime," said Doug Henson, former director of weapons systems at Sandia/California, who organized the trip.

The idea for the trip started when Doug received a holiday card from Carole, in which she shared news of several recent outdoor adventures she had been on. "I'm still healthy enough in retirement that I want to keep active, and I've always wanted to visit Africa," Doug said. "It dawned on me that Carole would be a great partner to make the trip, and we were in touch shortly thereafter."

Doug also reached out to their former colleagues Ming Lau and Doug Gehmlich, and Carole enlisted her sister, Annick, to join them on the trip.

Most of the group had worked closely for more than 20 years at the Livermore site, tackling major weapons systems engineering challenges. Now, the self-proclaimed 'Kili Five' had an incredible opportunity to renew friendships outside of Sandia.

"It was great to spend time with old friends that I had not seen since I retired," said Doug Gehmlich. "We worked together for a long time at Sandia, and it was great to share this accomplishment with them."

"While you're hiking and camping, there is really a lot of time to talk," said Ming. "We talked about family, hobbies, retirement and things going on in each other's lives. It was really great to be around each other again and to learn a lot more about each other."

Climbing Kilimanjaro

There are several routes to ascend the "Wonder of Africa," Doug Henson said. "We selected the eight-day trek designed to give us maximum acclimatization at high altitudes."

That meant the team would pass through several distinct climate zones along their trek and had to be prepared with appropriate clothing and equipment for a variety of weather conditions, including hot sun and cold winds. At base camp in the lower elevations, they were met with pouring rain amid the beauty of the rainforest. As they got further up the trail, giant heathers, wild grasses and a rocky trail replaced the trees and mud of the forest. Finally, the team passed through the alpine desert before negotiating snow and ice in their final ascent.

The team credits their trekking company, Climb Kili, for their successful summit. A team of 18 skilled guides, porters, a driver and a cook helped them navigate the trail, hauled much of their gear, set up and broke down camp and prepared meals for the 45-mile hike.

"Our guides were really well organized, which really helped make the trek a positive experience," Carole said. She recalled being greeted to camp each evening with a welcome song and dance. "It became a nightly tradition and brought us enormous joy. It was really special for us."

ATOP THE ROOF OF AFRICA — Four members of the 'Kili Five' pictured atop Mt. Kilimanjaro. From left, Doug Gehmlich, Doug Henson, Carole Le Gall and Ming Lau.

CELEBRATION SONG AND DANCE — Climb Kili greeted the team with a welcome dance and Swahili song as they arrived at camp at the end of each day's trek.

IN THE WILD — The team stops for a photo with a pat of flamingos in the background. From left, Doug Henson, Doug Gehmlich, Annick Le Gall, Ming Lau, Carole Le Gall, and ranger.

PICTURE-PERFECT POSTCARD — The safari lent the team up-close views of wild animals, including these zebras and water buffalo in the Ngorongoro Crater.

Following the Kilimanjaro trek, the group embarked on a nine-day safari excursion in protected national parks and conservation areas across Tanzania, including Ngorongoro Crater, Serengeti and Lake Manyara. A knowledgeable guide led the safari, which included a mixture of driving tours and short hikes, and helped the group spot a variety of wild animals, including baboons, impalas, giraffes, hippopotamuses, wildebeests and more. One day, a pride of lions approached the group and sat around their vehicle for about 30 minutes.

The last night on safari, the team said a lot of animals visited their camp. "Elephants chewed on trees, their bodies brushing against the sides of our tents. Lions were roaring right outside our tent. It was pretty unnerving," Carole said.

"When I think back on the trip, what stands out to me was an amazing comradery among the group," Carole said. "We really build relationships with the people that we work with side-by-side and year-after-year, and it was amazing to renew those friendships."

The group has talked about their next adventure, possibly a trip to hike Machu Picchu.

"I think it would be really hard to top Kilimanjaro," Doug Henson said.

MINDFUL BENEFITS — Mindfulness can help reduce injuries and incidents, enhance personal work performance and improve an individual's overall well-being.

Mindfulness needed in everything we do

By ***Joy MacPherson***
Photos by ***Dino Vournas***

"A few days ago, I watched someone who was texting walk into a light pole," Laboratories Director Steve Younger said in a recent email to employees. "We've had several incidents lately that reinforce the need to pay attention to what we do." While the incident was without injury, Steve said studies show that a rise in incidents like slips, trips and falls is an indicator of more serious problems down the road. He said we need to apply mindfulness in everything we do.

Mindfulness programs have been offered at Sandia since 2014 to help employees increase present focus and awareness. These programs aim to reduce injury and illness, decrease mental and physical stress and improve appreciation for life in its many forms.

Sandia's health, benefits, and employee services team collaborated with the occupational health and safety program to design the onsite mindfulness program as a pilot. The popular program was adopted Labs-wide in 2015. About 350 employees have completed the course at Sandia/California since its launch.

Data from the mindfulness programs show that injuries among participants are lower than the general workforce, proving that the intervention is an effective tool to reduce slips, trips and falls, and could have further impact on reducing injuries.

Mindfulness is an antidote to distracted living

Safety professionals are no strangers to the idea that it's important to pay attention, and mindfulness is just that — purposely paying attention to what you're doing. While this seems simple enough, multitasking and moving through life staring at our screens can be major distractions to paying attention. While there are many good and positive outcomes emanating from the digital world, there are also negative consequences — increased traffic and pedestrian accidents, workplace accidents, lost productivity and mental health issues, to name a few. Mindfulness is an antidote.

A review of safety and security incidents at Sandia shows the top causes are associated with distractions or interruptions, changes in routine, being in a hurry, multitasking and performing complicated tasks when personal energy levels are low. Sandia's mindfulness programs address these root causes by giving employees skills to self-regulate attention, thoughts and emotions while navigating work pressures and adapting to an ever-changing environment.

Karelyn Baker has completed Sandia's mindfulness training. "Mindfulness has helped me pay more attention to my body and how it's feeling — whether tired, tense or sore," Karelyn said. "I now notice my posture as I'm working, and am more aware of safety when I'm walking so I don't trip and fall."

The practice also spurred Karelyn to think about ways to take better care of her body and mind.

"I'm paying more attention to my thoughts and guiding them in positive directions," Karelyn said. "I find I'm more cheerful and optimistic that way. I enjoy the feel of the breeze, the lovely trees and the wildlife on site as I walk between buildings."

MINDFULNESS PRACTICE — Preventive Health Coordinator Joy MacPherson, right, visits with class participants before leading a mindful meditation class at Sandia's California site.

Mindfulness programs at Sandia

Sandia offers a variety of mindfulness training courses for all levels of experience. Those interested in learning more can also take advantage of weekly live and Skype meditation practice sessions, a variety of guided sessions through the Whil app (available via Virgin Pulse) and individual health coaching.

For more information about classes and enrollment, see the HR Events Calendar or TEDS Everyone or contact Preventive Health Coordinator Joy MacPherson.

Ducted fuel injection

CONTINUED FROM PAGE 1

Nitrogen oxides are also atmospheric pollutants, and the soot/NO_X trade-off meant that truck, car and equipment makers couldn't meet current legislated limits without adding exhaust-gas aftertreatment systems (analogous to catalytic converters on spark-ignition engines, but significantly larger and more expensive). But remove one of those pollutants almost entirely — like DFI does with soot — and Chuck said you have changed the game.

"Now that we've got soot out of the way, there's no more soot/NO_X trade-off," he said. "So we can add dilution — taking some of the engine exhaust and routing it back to the intake — to get rid of NO_X without soot emissions becoming a problem. It's like a two-for-one deal on reducing pollutants."

Chuck said that in engine experiments, his team has observed simultaneous, orders-of-magnitude reductions in soot and NO_X.

"This gives us a path to much lower emissions for diesel engines, solving a long-standing problem for this highly efficient technology," he said.

Renewable answer

The startling near-elimination of soot and NO_X may also open up the market for renewable fuels.

"Not only are the emissions dramatically lower, this combustion approach is truly synergistic with renewable, sustainable fuels, many of which are oxygenated," Chuck said. "That is, they contain oxygen bonded within the fuel molecule."

Chuck said that the synergies between DFI and oxygenated fuels should create a stronger market pull for emerging renewable fuels.

"Using oxygenated fuels with DFI lowers emissions more than DFI with conventional diesel fuel, perhaps enough to enable a less-expensive engine system because less exhaust aftertreatment would be required," he said.

"On a modern on-highway truck, aftertreatment amounts to about $12,000 in initial and operating costs over the life of the vehicle. Reducing even a fraction of those costs is a big deal, given the large number of these vehicles and their importance to the economy."

Engine manufacturers are "starting to show excitement" about DFI, Chuck said. Not only does it work well with conventional diesel fuel, manufacturers shouldn't need to retool their production processes extensively to use it.

"DFI is also retrofittable onto existing engines," Chuck said. "This is especially important for large engines, like those in ships or locomotives, where the engines can cost a million dollars or more, and full electrification is cost-prohibitive. A retrofit is relatively inexpensive and could provide substantial emissions benefits right away."

Paul Miles, manager of Sandia's engine research program, said the potential impact of DFI cannot be overstated.

"Breaking the soot/NO_X trade-off is the holy grail of diesel engine development," Paul said. "This is an example of the key role of government-supported research — to identify and demonstrate the potential of innovative, high-risk technologies to reshape the landscape for an industry, our transportation infrastructure and our society, and then to work alongside commercial partners to get the technology into the marketplace."

Ford and Caterpillar recently signed a cooperative research and development agreement with Sandia to help advance the technology.

Chuck is excited about moving this revolutionary breakthrough from the laboratory into production engines.

"DFI shows promise for giving us clearly superior engines for the future," Chuck said. "It should preserve all of the desirable attributes of a conventional diesel engine but also significantly lower the emissions, which lowers the cost of the engine system because you don't have to use as much aftertreatment, and it works even better with current and emerging renewable fuels."

This research was conducted as part of the Co-Optimization of Fuels and Engines initiative sponsored by the DOE Office of Energy Efficiency and Renewable Energy, through the Vehicle Technologies and Bioenergy Technologies offices.

Computer modeling

CONTINUED FROM PAGE 1

Scientists can deal with this by generating a single multiscale model, or computer mesh, of the object of interest. Unfortunately, if the object is complex, this so-called meshing process can take months.

19th century inspiration

Alejandro had tried several methods to make computer modeling better. Then he and Irina began thinking about the Alternating Schwarz method, developed in the late 19th century by German mathematician Hermann Schwarz.

"In 1870, he had this problem with a circular geometry and a rectangular geometry," Alejandro said. "He knew how to solve both problems separately. But he wondered if he could combine them to obtain a solution for the geometry of both of them combined. He figured out you can."

Irina said they applied that thinking to calculating models of component parts of a whole system.

"Suppose we have a system where several plates are bolted together," she said. "Rather than solving the relevant equations on the whole geometry all at once, you solve the equations first for the bolts, then on the plates, incorporating into this second computation the first solution obtained on the bolts.

"You repeat this process many times. The configuration changes during the computation because, at each iteration, information propagates from one region to the other. This links the regions together — couples them."

Alejandro said the years of research, funded through the physics and engineering models and advanced simulation and computing programs, would not have been possible without the support of their sponsor, Eliot Fang.

"I first started talking to Alejandro about this three years ago," Eliot, who manages the funding, said. "When you evaluate projects, you are not guaranteed an outcome. This is called R&D risk. But all the surprises in this are on the happy side. Both Alejandro and Irina are highly capable. It was a blast for me to work with them."

21st century solution

Alejandro and Irina began using the Albany coding test bed and Trilinos suite of algorithms to test their modeling method. The method also works to model the structural integrity of different materials.

"You have these two pieces of metal and a weld connecting them. You are going to stretch it and you want to see how the weld is going to fail or what's going to happen to it," Alejandro said, adding that because the method allows elements of a system to be separated, computing resources are needed only for creating the fine details of the immediate area of the weld, rather than modeling the entire system.

"If you have a problem that's going to take months to compute, we believe we can reduce that to weeks," Alejandro said. "People want to simplify this problem in order to obtain answers in a reasonable amount of time or with reasonable computational resources. It's labor intensive and computationally expensive."

Irina said that the method will really save time when researchers want to model multiple designs.

"If you want to play with different designs — bolts with threading, bolts without threading and so on — for each one you will have a substantial savings," she said. "You will not have to spend all that time — months, possibly — creating a single model or mesh for each variation. The more designs you want to test, the more savings you're going to have."

Eliot said the method has already created demand.

"There are teams with mechanical analysis problems that are actually waiting for this method to be approved so they can apply it," he said.

A world of possibility

Alejandro said the method is now being used in production at Sandia in the Sierra code. He and Irina agree that the potential of the method is limited only by the imagination of the researchers.

"There's some art to it," Irina said. "For each problem, you have to have some intuition about how to break up the relevant geometry into small and large scales."

Alejandro agreed that the art is in how you use their method.

"You name it: engineering systems, biological systems. You can go wild imagining where you can apply this," he said.

FINDING SOLUTIONS — Alejandro Rota, left, and Irina Tezaur explain how their new computer modeling system can solve problems for each piece of something, like bolts in a lamppost, reducing the time it takes to render the model. **Photo by Michael Ellis Langley**

SANDIA CLASSIFIED ADS

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. At the bottom of the NewsCenter page, click the **"Submit a Classified Ad"** button and complete the form.

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

MISCELLANEOUS

STATIONARY EXERCISE BIKE, like new, $30. Marchi, 505-265-6211.

ARCHERY COMPOUND BOWS: 017 Hoyt Carbon Turbo, #60-70, @ 29-in., $875; Hoyt Vector 32, #50-60, @ 29-in., $300. Schroeder, 505-917-4516.

MEDICAL BED, new, used 4 nights, paid >$1,600, asking $1,000 OBO. Andreatta, 505-239-5505, leave a message.

STING TICKETS, 2, Sept. 2, in Taos, Kit Carson Park, sold out show, $500/both. Brewster, 505-238-4704.

SMALL TRUCK BED SLIDE, $100. Jones, 505-275-5668.

ROUTER, Asus AC2400, $85; range extender, Amped SR20000G, $20; high power, dual band. Sutherland, 505-345-1183.

PLASMA TV, 65-in., Samsung, https://tinyurl.com/y6qzcw43. Weagley, 505-385-4059.

UPRIGHT PIANO, 45-in., Yamaha P22, great condition, first owner, must pick up from Los Alamos, $2,500 OBO. Li, 505-695-5238, ask for Olivia.

FUTONS, full-size, $75; twin size, $50, no mattresses; wrought iron storm doors, $400; photos available. Maldonado, mussel crowe50@yahoo.com.

ELECTRIC DRYER, Amana, 2018, excellent condition; Frigidaire washer, electric, good condition, works well, $300/both. Drebing, 505-235-4144, ask for Janis.

BEDROOM SET, queen, solid oak, Mission-style, clean lines, head/footboard, rails, armoire, chest, 2 night stands, $500. Selcher, 505-977-4057.

HO GAUGE TRAIN, table-top, w/track, $25. Stubblefield, 505-263-3468.

TABLE, CHAIRS, LEAF & HUTCH, pecan, $600/all; shop machines, tools, more; call for details. Siegrist, 505-293-4148, leave message.

'11 TOYOTA TACOMA, factory rims, 4, w/o tires, good condition, $400 OBO. Shaw, 505-917-1559.

TRANSPORTATION

'11 JEEP PATRIOT LATITUDE, 4WD, tow pkg., roof rack, heated seats, 91K miles, very good condition, $8,250. Lau, 505-388-5941.

'12 VOLKSWAGEN JETTA SEDAN, steel gray exterior, ~71K miles, very good condition, $10,000. Marquez, 505-864-8245.

'08 SOLSTICE GXP TURBO, convertible, yellow, Alcantara upholstery, engine dressup, very fast, 70K miles, $10,000. Kravitz, 505-867-3676.

'16 FORD F150 XLT, 4x4, 2.7L, V6, supercab, totally loaded, locking bed cover, 15K miles, like new, must see, $32,000. Wright, 505-350-7651.

'15 MAZDA 3 HATCHBACK, 2.0L, AT, deep blue, 1 owner, clean title, only 34K miles, excellent condition, $12,000 OBO. Zalesak, 505-269-7575, call or text.

'18 TOYOTA YARIS iA, 4-dr. sedan, AT, sport option, white, 19K miles, salvage title/minor accident, runs like new, way below NADA, $8,000. Dwyer, 505-249-6935.

'05 MINI COOPER S, 6-spd., 2-dr., convertible, blue, low miles, 51K miles, good condition, $5,500 OBO. Cummings, 505-220-6480.

'07 FOOSE STALLION MUSTANG LE, Saleen supercharged V8, 465-hp, cinnamon/black, 8,970 miles, excellent condition, $34,000. Myers, 904-536-5920 or steppdesign@hotmail.com.

RECREATION

'10 VESPA PIAGGIO BV250 SCOOTER, always garaged, 70-mpg, only 2,570 miles, like new, VIN report & manuals, must see, $1,950. Langwell, 505-350-1313.

'17 AVENGER TRAVEL TRAILER, 17-ft., full bath, used 1 time, stored inside, paid $14,000, asking $10,000. Hapka, 505-220-9114.

REAL ESTATE

2-BDR. HOME, 1 bath, 1,200-sq. ft., 1-car garage w/storage, 1527 Hermosa Drive NE, 87110, Altura Park/UNM location, $215,000. Ramos, 972-951-0290.

10 ACRES, Tijeras property, invest or build dream home, gorgeous mountain views, near I40, electric onsite, $79,000. Romero, samambrome@gmail.com or 505-263-6332.

2-BDR. TOWNHOUSE, 2 baths, 1,452-sq. ft., newly updated, Far NE Heights, call for private showing. Lydick, 505-453-8194, ask for Erica.

3-BDR. HOME, 2 baths, 1,400-sq. ft., fully remodeled kitchen, landscaped backyard, near Cibola High & Cottonwood Mall, $220,000. Nico, 505-803-3701.

3-BDR. HOME, w/loft, 2-1/2 baths, 1,700-sq. ft., central AC, NE Heights, Eldorado school district. Zebick, brianzebick@gmail.com.

3-BDR. PATIO HOME, 2 baths, 1,760-sq. ft., Southwest-style, against Tijeras Arroyo, 15 mins. to KAFB, FSBO, $270,000. Kopczuk, 505-275-3403.

WANTED

FURNITURE: table, chairs (for 6 or 8); sleeper sofa, gently used, donate to Vista Grande Church missionary cabins. Martin, 505-281-7227.

GOOD HOME, female cat, beautiful tan/grey/white, call or text for more detail. Lund, 505-362-9977.

ROOMMATE, male or female, large room, private bath, kitchen, patio, views, I40/Coors, $575/mo. +1/2 utilities (~$125). Williamson, 505-321-4531.

KID'S BDR. FURNITURE, gently used, twin bed frame, dress, bookcase, etc., willing to pick up. Black, 505-331-9147.

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.

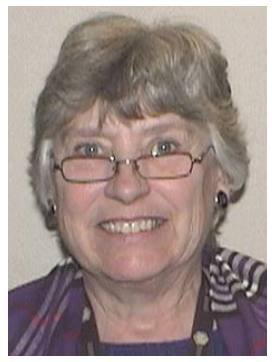
Mileposts

New Mexico photos by Michelle Fleming
California photos by Randy Wong


Ann Hodges 45


Tony Bryce 35


Curtis Gibson 35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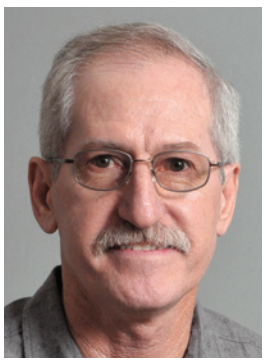
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Jimmy Potter 30


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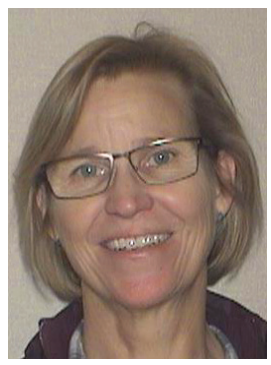
James Gruetzner 25


John Hatley 25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Bernie Jokiel 20


David Wick 20

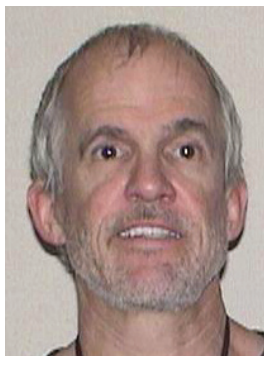

David Bishop 15


Adam Brewer 15


Ruben Cazares 15


Marla Clary 15


Timothy Edwards 15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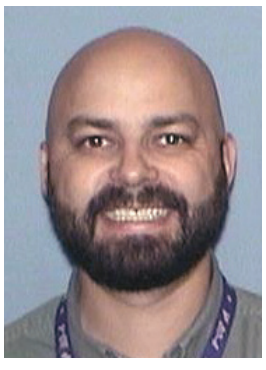
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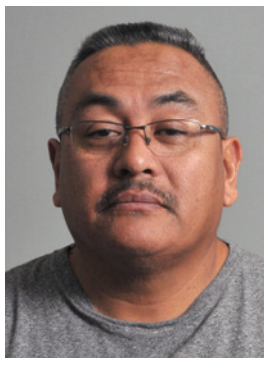
Matthew Martinez 15


Joseph Saiz 15

Puerto Rico work

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environments within a defined framework. This framework includes tools, procedures and metrics to develop a defensible and reasonable plan based on current state and future state resilience. Puerto Rico precipitated action in the energy resilience space to the U.S. Virgin Islands and similar rural, island-like environments.

DOE's support and Sandia's research and development expertise were showcased during a multi-lab effort to further develop resilience metrics around societal burden and critical need access. Two such studies include resilience research in Norfolk, Virginia, and New Orleans, Louisiana. These studies are informed by a universal framework based on infrastructure modeling, simulations and algorithms. The models inform risk assessment and Sandia's systems analysis to pinpoint areas of concern as well as areas that present the most opportunity for resilience.

The study in Norfolk assessed how the city and region could be adversely affected by a natural disaster, namely rising sea levels. Norfolk was identified as a critical resource center, as it is home to the world's largest naval station and critical seaports. With the help of Sandia, Norfolk pinpointed key areas in the city that were less likely to be affected by flooding. The city was then able to develop policies and procedures to better prepare infrastructure, should the city flood.

Similarly, Sandia and Los Alamos national laboratories partnered with the City of New Orleans to pinpoint opportunities for resilience, including support of key services in the wake of natural disasters, such as hurricanes. The team used historical flood data and forward-looking flood models to illustrate how severe flooding could isolate various portions of the community from electrical supply and lifeline services.

Sandia developed a tool to identify key community resources, such as hospitals and grocery stores, that were less likely to be affected by flooding and more likely to be useful after a hurricane. Based on these flooding models, cities and governments can identify opportune locations for microgrid placement that will provide access to critical infrastructure, should the city flood.

Much of the ongoing microgrid work in Puerto Rico was informed by studies of mainland cities and regions. There is a dire need to focus research and infrastructure efforts on rural, isolated and island settings, such as Puerto Rico, the U.S. Virgin Islands and arctic communities, due to their susceptibility to power outages. Because certain locations are key to national security, microgrids for resilience has gained firm support from DOE as a new research and development space.

"There are a lot of similarities and parallels between rural and remote and arctic and island communities," Abraham said. "Our goal is to reduce to societal burden after an outage regardless of geographic region… For now, our focus is Puerto Rico and the Caribbean, but eventually we could take this to other island nations or the Arctic."

The team would like to remember Bill Fogleman, a Sandia contractor who was critical to the phase two Puerto Rico resilience project work. Bill passed away in late April. He will be missed.

TOSS — Ben Nilsen, left, guards Brett Sterneckert as he throws a backhand (left photo). Ben Nilsen, right, rises to grab the disc with Dalton Bradley defending (right photo).

Hammer throws, hucks, flicks and pulls

Sandians play ultimate frisbee to exercise and make connections

By ***Rich Ellenson***
Photos by ***Dino Vournas***

Launch angle, advection, angular momentum and aerodynamics. Is Sandia firing a rocket into space? No, not this time. Instead, California Sandians are calculating these factors to "huck" a 175-gram plastic disc during a game of ultimate frisbee. Sandia's ultimate frisbee group meets Wednesday evenings at Tex Spruiell Park in Livermore.

You do not need a degree in engineering or biomechanics to play. Ultimate frisbee games are friendly, open to all levels and non-contact — you don't need to have played before. The group's organizer, Michio Poppleton, said, "Our members are willing to accommodate players who have never even picked up a disc." The group is "very open and … no judgments at all," said player Brett Sterneckert. "People will take the time to teach about rules and different strategies."

Michio said that there is a wide range of talent that keeps the action fresh, "In terms of experience, a number have been playing for many years on official teams, some of them have hardly played at all and many fall in various places along that spectrum."

Michio said he started playing in high school before he knew how to throw a backhand and has been hooked ever since, showing no signs of slowing down. "I can help to share the game that I love with so many people, all at the place where I work," he said. "For this, I'm honored and incredibly thankful."

The group has been playing for more than 10 years, most often in the spring and summer when daylight lasts later. The games are a great way to network with Sandians and a few members from Lawrence Livermore National Laboratory, that players may not otherwise meet. Better yet, it's free to play. Brett added that ultimate frisbee is a "good way to spend an hour after work and beats paying for a gym membership."

Michio said the group welcomes any amount of participation in their pick-up games. "A person can join even during mid-game, and can play for as long as desired," he said. "This setup produces an ideal venue for new players to join without high stakes pressure, and also accommodates players who may need to leave early or arrive late for any reason."

How does it work?

An official ultimate frisbee field is about the size of a soccer field, but for casual games, the field size is determined by available space, sprinkler head avoidance and general desire — or lack thereof — to run far that day. Ideally teams have seven players on each side with some substitutes, but games are played with fewer people if necessary.

After players line up on opposite sides of the field, one team "pulls" or throws the disc to the other team like a kickoff in football. Players on offense pass the disc until their team scores a goal by catching the disc in the opposing end zone. Defensive players try to intercept passes or simply knock down the disc, causing a turnover, which puts them on offense.

Gameplay is a combination of soccer (constant movement until a goal is scored, with frequent offense/defense changes), basketball (once you catch the disc, you establish a pivot foot and may not run) and football (points are scored by catching the disc in the end zone). If this sounds too complicated to learn, the group will gladly teach new members and spread the joy that is ultimate frisbee.

Like all ultimate frisbee games, the ones at Tex Spruiell Park are played without referees, so players make their own calls, which encourages a kinder experience in line with the spirit of the game. Players play to have fun and get exercise, and not to get injured. Sessions are usually just played to five points, and points are not recorded until the end of the session.

To learn more about this group, visit ultimate.sandia.gov to join the email list and find out about other games near the California campus offering higher-level play.

Ultimate frisbee games are also played at Sandia's Albuquerque campus. For more information, email majordomo@sandia.gov with the message text: Subscribe ultimatefrisbeeatsnl and your email address.

REACH FOR IT — Tina Chou, left, rushes in to block as other players grab for the disc.

GOOD SPORT — Organizer Michio Poppleton, right, exchanges post-game congrats after a well-played day of ultimate frisbee.