SANDIA LABNEWS
PUBLISHED SINCE 1949
Vol. 74, No. 12, June 30, 2022

Researchers recount Arctic expedition **Page 8**

Using the power of the sun to roast green chile

TASTIN' TIME — From left, Sandia intern Aaron Overacker, technologist Daniel Ray and project lead Ken Armijo display solar-roasted green chile before surveying chile connoisseurs on their peel-ability, taste, texture and smell. **Photo by Randy Montoya**

Greener approach to a New Mexican staple opens possibilities for sustainable food roasting

By **Mollie Rappe**

Every August and September the unmistakable pungent aroma of roasting green chile permeates the air across New Mexico and neighboring states.

This delectable staple of regional cuisine is green in color, but roasting the chile pepper to deepen the flavor and make the inedible skin easier to remove is hardly environmentally friendly.

— CONTINUED ON PAGE 5

Answer the call

Labs director urges workforce to focus on nuclear programs amid Russia, China nuclear acceleration

By **Katherine Beherec**

Sandia Labs Director James Peery urged the workforce during an all hands meeting last week to accelerate nuclear weapons modernization as China multiplies its arsenal and Russia threatens nuclear war.

"The nuclear expansion is unlike anything since the beginning of the atomic age," he said. "There are continued discussions going on about adding new things to the stockpile beyond the ongoing modernization programs. These discussions are going on because our adversaries are marching very quickly to adding new capabilities."

— CONTINUED ON PAGE 7

ALL HANDS ON DECK — In an all hands meeting on June 23, Sandia Labs Director James Peery urged the workforce to volunteer their expertise to the nuclear weapons programs as the Labs accelerates weapons modernization. **Photo by Craig Fritz**

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

Sandia National Laboratories

Albuquerque, New Mexico 87185-1468
Livermore, California 94550-0969
Tonopah, Nevada | Kauai, Hawaii
Amarillo, Texas | Carlsbad, New Mexico | Washington, D.C.

Katherine Beherec, Editor kgbeher@sandia.gov
Alicia Bustillos, Production abustil@sandia.gov
Craig Fritz, Photographer cvfritz@sandia.gov
Paul Rhien, California Site Contact prhien@sandia.gov

CONTRIBUTORS

Michelle Fleming (milepost photos, 505-844-4902), **Neal Singer** (505-846-7078), **Stephanie Holinka** (505-284-9227), **Kristen Meub** (505-845-7215), **Troy Rummler** (505-284-1056), **Manette Fisher** (505-844-1742), **Valerie Alba** (505-284-7879), **Luke Frank** (505-844-2020), **Michael Langley** (925-294-1482), **Meagan Brace** (505-844-0499), **Mollie Rappe** (505-288-6123), **Skyler Swezy**, (505-850-2063), **Michael Baker** (505-284-1085)

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

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

LAB NEWS ONLINE: sandia.gov/LabNews

TABLE of CONTENTS

LABNEWS Notes

Lab News may contain photos shot prior to current COVID-19 policies. Individuals in photos followed all social distancing and masking guidelines that were in place when photos were taken.

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

Pipelines for progress

FOCAL POINT — Summer intern Brooke Davis, left, with the aid of Morgan Mackenzie prepares algae samples for a microbiome investigation at Sandia. **Photo by Craig Fritz**

Sandia program eyes HBCUs for talent

By **Luke Frank**

Sandia is sharpening its focus on select historically Black colleges and universities with its Securing Top Academic Research and Talent program.

START builds academic partnerships that align with Sandia's mission needs to fuel research collaboration and expose prospective underrepresented students to cutting-edge national laboratory work. In turn, Sandia creates an employee-recruiting pipeline for some of the strongest engineering talent in the U.S. in a competitive market.

"The START program adds to Sandia's inclusive and diverse culture, while attracting, developing and retaining a highly qualified, dynamic, diverse workforce to strengthen our mission impact through innovative solutions," said Rahni Kellum, START HBCU program lead. "We've had recruiting relationships with HBCUs but not at this depth of commitment. It's pretty exciting."

The program, under construction prior to the pandemic, has four strategic foundational elements supported by Sandia leadership: HBCU partnership development, research opportunities and alliances, STEM program partnerships, and talent recruiting and acquisition. About a dozen Sandia Laboratory Directed Research and Development projects have been earmarked for intern participation, including work in materials science, engineering sciences, robotics and computer information systems. Funding for the program comes from Sandia through multiple projects, with a goal of developing outside funding as the program matures.

"Sandia believes that enhancing research partnerships with HBCUs in this way will allow us to expand the diverse talent pool available in our job searches and ultimately increase the innovation and diversity of our workforce," said Susan Seestrom, Sandia's chief research officer.

That support from Sandia's highest levels of leadership has enlivened the effort. "We've found a lot of energy within Sandia for the START program," Rahni said. "We have numerous advocates, including Sandia executive staff, who are championing the program. There also are a lot of Sandia volunteers working with us, which is important because this is essentially a homegrown program."

Matching capabilities with missions

Sandia has identified five HBCUs with strong science and engineering programs that match Sandia's national security and other missions and enjoy robust enrollment in advanced degrees in science, technology, engineering and math to join START:

Florida A&M University-Florida State University College of Engineering is a collaboration between a top historically Black university and a Research-1 institution, meaning it's a doctoral university with high research activity, according to the Carnegie Classification of Institutions of Higher Education.

Norfolk State University College of Science, Engineering and Technology offers several graduate programs with emphases in material science, cybersecurity and computer science.

North Carolina Agricultural and Technical State University College of Engineering has seven departments offering 23 degrees at the undergraduate, master's and doctoral levels.

Prairie View A&M University is composed of six departments that provide a deliberate balance between engineering classroom theory and research application.

Alabama A&M University College of Engineering focuses on electrical, civil, mechanical and materiel engineering, computer science, physics, chemistry and mathematics.

Sandia also is exploring relations with Tuskegee University and Morgan State University.

INTERN OUTPUT — Brooke Davis, a molecular and microbiology summer intern from University of Arkansas at Pine Bluff, prepares algae samples for a microbiome investigation at Sandia.

Photo by Craig Fritz

Eyeing the best pupils

The program relies on continuous communication between Sandia and the participating universities at every level, from leadership to faculty to the researchers and students themselves.

At the highest level, Sandia executive champions hold monthly virtual meetings with research and engineering leadership at each of the five institutions. "They discuss big-picture strategies, like appropriately aligning the program and building awareness through campus events and communications," Rahni said.

"Meanwhile, Sandia researchers and school faculty zero in on ground-level activities, like identifying specific collaborative research opportunities and planning campus visits," Rahni said. "Importantly, this is often where we strategically pair Sandia researchers with HBCU faculty to ensure talent on both sides align with specific Sandia research projects and goals."

Sandia program champions and researchers also provide critical on-site one-on-one meetings between leadership, researchers, faculty and students. These in-person meetings create relationships that help to refine program strategies and specific research partnerships, while building collaborations in the trenches for technical workshops, career fairs, information sessions, professional development and other frontline activities for prospective students.

"Sandia actually came to my class," said Tamar Ambers, a student at Prairie View A&M and Sandia project-controller intern. "It wasn't a career fair. It wasn't like they wanted to be seen around campus. They came into a freshman class. We have 17- and 18-year-olds just graduating high school and they're talking to us about this job, this program."

One such project involves students with FAMU-FSU's High-Performance Materials Institute, which focuses on composite and nanomaterials, structural health monitoring, multifunctional nanomaterials advanced manufacturing and process modeling. "My students are working with Sandia scientists measuring and designing materials' performance in extreme conditions after introducing additives, learning how and why they fail or endure," said Rebekah Sweat, an assistant professor with the FAMU-FSU College of Engineering and institute. "We're also coplanning a materials technical workshop here between FAMU and Sandia.

"Last year three scientists from Sandia came and talked with our students," Sweat said. "They answered all technical and nontechnical questions from the students, who enjoyed the mentorship of the Sandia scientists across career development and educational pathways.

"The personal touch Sandia has provided has been special. My students really want to be inspired by their work, and the projects at Sandia have been a perfect fit."

Deeper dive into diversity

Sandia believes that diversity generates discovery. "By embracing inclusion and diversity, Sandia creates an exemplary culture for success," Labs Director James Peery wrote in a letter to the workforce this May. "A diverse workforce demonstrates the Labs' strength and richness by delivering exceptional service from varied experiences and perspectives."

James called it a business imperative.

"Inclusion and diversity make Sandia a stronger national laboratory and help us achieve our missions by bringing unique backgrounds and perspectives to the problems we solve," he said. "We also become a better place to work. This program better equips all employees to create a culture that yields more innovation and better business results. It's just good business."

Don Gillich, Sandia manager in research and development science and engineering, also sees the business value in START. "I have been impressed with our HBCU interns' quality of education," he said. "In addition to the research partnerships, START provides us an opportunity to hire from different areas of the country."

Rahni said the program will continue to grow. "This year, Sandia's operations division is piloting a START HBCU Internship Institute," she said. "We have about 16 interns on roll for this pilot." And the START program is prospecting beyond the STEM platform into environmental science, management and marketing.

"This is a deeper, strategic alliance that directly connects to Sandia's national security missions," said Rahni. "These START partnerships are specifically designed to advance our innovative research programs while developing our future workforce."

Interns volunteer at local food bank

SNACK PACK — Sandia interns volunteered at Roadrunner Food Bank in June and packed more than 400 boxes of food that were distributed to people experiencing food insecurity in New Mexico. **Photo courtesy of Roadrunner Food Bank**

Solar-roasted chile

CONTINUED FROM PAGE 1

In New Mexico alone, burning propane to roast the peppers leads to a seasonal emission of approximately 7,800 metric tons of carbon dioxide — the equivalent of driving 1,700 cars for a year.

Sandia engineer Ken Armijo, who grew up on a chile farm in Sabinal, located between Albuquerque and Socorro, thought there was a "greener" way to roast green chile. The results of his experiments roasting chile with concentrated sunlight will be shared at the American Society of Mechanical Engineers conference on energy sustainability this July.

"The principle behind this research was to see if high-temperature food roasting, not just peppers, could be done with solar and produce comparable results as traditional propane roasting, and the answer is yes," Ken said. "We used green chile to showcase the culture of New Mexico. Combining the state-of-the-art facilities and research at Sandia National Labs with the culture, food and people of New Mexico is just so special. What other national lab in the world would have done this?"

Ken uses the power of the sun at Sandia's National Solar Thermal Test Facility to explore new ways to capture the sun's power for electricity and industrial process heat.

Solar-roasted green chile

For decades, Sandia has developed technologies that convert renewable resources like wind and sunlight into electricity and useful heat without producing greenhouse gases. Demonstrating these technologies in the real world provides valuable testing and validation. Ken's demonstration of using solar power to roast green chile could inspire new applications of solar technologies and new avenues of research.

With the assistance of several Sandia engineers, technologists and interns, Ken got a traditional steel-drum tumbling chile roaster to the top of the 200-foot tower at Sandia's National Solar Thermal Test Facility and protected the rotor mechanism from the intense solar heat.

Ken's father, a chile farmer and roaster, donated several burlap sacks of green chile and his experience assessing properly roasted chile. Ken's father grows organic, heirloom chile from seed passed down through multiple generations.

Using 38 to 42 of the 212 heliostats — mirror-like devices used to focus sunlight — at the thermal test facility, Ken was able to achieve a temperature above 900 degrees Fahrenheit uniformly across the roasting drum, he said. This is comparable to the temperature of a traditional propane chile roaster.

He used concentrated solar power to roast three batches of 22 pounds of green chile: two that had been washed immediately prior to roasting and one that was dry roasted. The washed chiles took slightly longer to roast than the dry chile, but the amount of charring was more uniform, and the flavor profile was preferred by green chile connoisseurs, Ken said.

Afterward, Ken's team returned the chile roaster to the ground and roasted three more batches of green chile using traditional propane. Propane was slightly faster, taking four minutes to roast washed chiles compared to six minutes for the fastest solar chile roast. With further experimentation, and using more heliostats, Ken thinks they can roast chile even faster than with propane, but he didn't want to scorch the chile during his first experiments.

SETTIN' UP — Sandia engineer Ken Armijo sets up a number of infrared cameras and data collection devices before the solar chile roast.

Photo by Randy Montoya

"With the solar roasting we were actually able to achieve a more uniform distribution of heat," Ken said. "With propane roasting, you just get heat right where the burners are, but all the chile piled on top isn't really getting heated as efficiently. We saw with our infrared cameras that with solar, it's more uniform. In essence, the heat is reaching all the chile in the front of the roaster. In practice, this has a lot of potential for roasting chile more quickly, with better quality, as well as greener."

"Green," green chile

For each of the traditional propane roasts, Ken recorded the amount of propane used to roast 22 pounds of green chile and found that switching from propane to solar power would reduce greenhouse gas emissions by 2.68 pounds per 22 pounds of green chile roasted. If the whole state of New Mexico switched to solar chile roasting, the net result would be the equivalent of planting 130,000 tree seedlings and letting them grow for 10 years annually.

It's great to roast green chile sustainably; however, if consumers don't like the taste of solar-roasted chile, it will never gain acceptance. That's where the second part of Ken's study comes in.

Ken presented 14 green chile connoisseurs with both solar-roasted chile and traditional propane-roasted chile and surveyed them on a variety of chile qualities. He found that on average, the respondents favored the solar-roasted chiles by 18% for flavor, 12% for smell and 2% for ease of peeling off the inedible skin. However, the respondents preferred the texture of the propane-roasted by 4%.

"I did a survey and overall, the participants preferred the

CHILE ROAST

A SHORT VIDEO OF ROASTING GREEN CHILE ON TOP OF THE SOLAR TOWER. VIDEO BY RANDY MONTOYA

solar-roasted chile to the propane-roasted chile," Ken said. "That was shocking to me. They preferred the taste because it didn't have as burnt a taste. They said it just tastes cleaner of green chile."

From portable roasters to coffee beans

Ken acknowledged that it's not feasible to build a tower and field of heliostats just for roasting foods like green chile, coffee or grains. However, he and his colleagues are exploring a much smaller and more modular solar-roasting system that conceivably could be transported to farmers' markets, grocery stores and chile festivals for roasting small batches of green chile, like the propane-burning steel-drum chile roasters currently use.

"In the future, I hope chile roasters will pull up to farmers' markets and festivals with a trailer with a modular mirrored roaster," Ken said. "They just pour the chile in, point the system at the sun and let it roast. That would just be awesome."

But Ken says solar roasting isn't just for green chile. Concentrated sunlight could also be used to roast other foodstuffs such as soybeans at 840 degrees Fahrenheit for animal feed and human food; grains for beer at 200-400 F; almonds and cashews at around 300 and 266 F; and even coffee. French roast coffee is roasted until the beans reach 464 F, and coffee beans are roasted until 350-400 F for light roast coffee. Traditionally, fossil fuels like propane or natural gas are used for these processes.

New Mexico has practically perfect weather for solar roasting, with an average of 300 days of sunshine each year, Ken said. And many other crop-producing locations get plenty of sunny days, too. The almond production region of California gets 260 days of sunshine, particularly in the summer and fall. In fact, two companies in California are working on pilot plants to use concentrated solar power for lower temperature processes, such as pasteurizing almonds. Coffee farmers in Colombia, Ecuador and Peru grow and roast at high altitudes, which is also perfect for using solar to roast coffee, Ken added.

When it comes to the future of green solar-roasted foods, the sky's the limit.

SIZZLIN' CHILE — Roasting green chile on top of Sandia's National Solar Thermal Test Facility. Roasting green chile with concentrated sunlight instead of propane produces flavorful chile and reduces carbon dioxide emissions.
Photo by Randy Montoya

ROASTIN' TIME — Sandia engineer Ken Armijo installs a chile roaster on top of the solar tower above a field of mirror heliostats. Ken will present his research at a conference on energy sustainability this July.
Photo by Randy Montoya

Answer the call

CONTINUED FROM PAGE 1

The DOE has asked Sandia to increase its modernization efforts in response to how quickly China has expanded its stockpile, James said during the June 23 presentation while outlining the nuclear landscape globally and emphasizing that Sandia must quickly advance its weapons work to maintain an effective nuclear deterrent.

To drive the point home, James shared a clip of Adm. Charles Richard, head of U.S. Strategic Command.

"Two years ago, the great debate was whether China was going to double its stockpile by the end of the decade. That's already happened while I've been the commander of U.S. Strategic Command," said Richard, speaking to the Senate earlier this year. "This is easily the biggest expansion in China's history and rivals the biggest expansion of any nation in history, including us and the Soviet Union back in the early '60s."

James spoke about the importance of staying on schedule. He said the nation is asking Sandia to quickly modernize nuclear weapons on a fixed budget, so it is important to negotiate requirements to meet deadlines.

"This Lab absolutely hums when requirements are negotiable," he said.

One of the biggest roadblocks to achieving these outcomes is lack of experienced personnel. James challenged the workforce to think creatively about solutions. Some ideas included partnering with outside organizations, like other national laboratories, to lighten the load of Sandia staff so they can focus resources on nuclear deterrence work. He also suggested recruiting staff internally to contribute their expertise to the core mission and embracing peer review by outside organizations. Lastly, he encouraged experienced staff to mentor new hires. James said Sandia is updating its policies to rehire retirees and increase expertise in the workforce.

There are many opportunities for staff outside of nuclear weapons groups to contribute their capabilities to the Labs' primary mission. Asking Sandians to think of how they could help the effort whether they worked in Nuclear Deterrence or not, James reflected on his personal experience earlier in his career while working in Sandia's shockwave physics group.

"When I got my clearance, my supervisor sat me down and said 'You know, James, we brought you in to write this rad-hydro code, but there will be times when the nuclear weapons program needs your help, and you're going to stop writing that rad-hydro code, and you're going to go help them. Until you're done, you're not going to go back to writing that rad-hydro code,'" James said. "Just as predicted, it happened three or four times in my technical career at the Laboratory."

During this time, James worked on devices that contain explosive neutron generators tests, helped resolve an issue on a fire set and analyzed the safety of a nuclear device. "This was some of the most rewarding work that I got to participate in. I'm very proud of that work," he said.

At the end of his presentation, James invited questions from the audience. In response to questions, he acknowledged concerns about supply chain delays and offered ideas to engage staff from other organizations in the nuclear programs. Using an example of needing electrical engineers, he suggested that rather than filling all open positions, which is unlikely to happen soon, Labs leadership may ask other internal organizations if they are willing to do electrical engineering work in service of the nuclear programs.

James will host a Q&A session on July 18 from 2-3 p.m. to answer questions and ideas from the workforce that may arise after reflecting on the messages he shared last week.

"There's no way we can get this done without all of us," James said. "This is a really critical time for the Laboratories and a critical time for the nation."

Expedition above the Arctic Circle

Two Sandians brave subzero temperatures, frozen tundra to deliver vehicle to research site

By **Sarah Jewel Johnson**

Sandia's arctic and atmospheric research is vital to understanding the effects of climate change in the Arctic and around the world. Every year, scientists battle the Alaskan wilderness to collect critical data, but none of their cutting-edge research would be possible without dedicated operations and logistics staff who ensure Arctic facilities, supplies and vehicles are safe and ready to use.

Sandia engineer Fred Helsel and technologist Valerie Sparks recently went above and beyond their usual duties to deliver a new General Services Administration vehicle to the DOE's Atmospheric Radiation Measurement user facility in Utqiaġvik, Alaska, formerly Barrow. Fred, North Slope of Alaska operations manager for the Sandia-operated observatory, and Valerie, who has supported logistics for Sandia's Alaskan facilities for over a decade, spent four days in April braving miles of frozen tundra and avalanche-ridden passes to personally deliver a new Ford Expedition that will serve as crucial transportation for Sandia staff and their arctic and climate change research.

"Earlier in the year we started having trouble with our current GSA vehicle in Barrow [Utqiaġvik], and we found out the Ice Road was open. So, Fred and I were going up there anyway and we just decided, we should do this road trip. It was a win-win: We get the vehicle to Barrow [Utqiaġvik] quickly, and we get a once-in-a-lifetime experience on the Ice Road," Valerie said.

Packed to the gills on the Ice Road

The first day of the trip was the easy leg, stretching from Anchorage six and a half hours north to Fairbanks. Here, Fred and Valerie collected supplies required for their long voyage across the frozen tundra just days away.

"We were packed to the gills," Valerie said. "We had to carry 35 gallons of extra fuel, two spare tires, three days' worth of extra food and water, extra arctic clothing and we even set up a rack on the back of the vehicle to carry what we couldn't fit inside."

On April 4, Valerie and Fred ventured 497 miles farther north from Fairbanks to Deadhorse on the Dalton Highway, better known as the Ice Road. This gravel highway is considered one of the most isolated in the world.

"When they said, 'Ice Road,' I was expecting a road of pure ice, but it's really

PERILOUS PASS — Atigun Pass, at 4,739 feet, is considered one of the most dangerous passes in Alaska due to frequent avalanches.

Photo courtesy of Valerie Sparks

more of a snow trail. It goes across rivers and lakes that are frozen, and that's why you have to do it before it all melts," Fred said.

The drive lasted 10 1/2 hours and took them through Atigun Pass, where the Dalton Highway crosses the Continental Divide at 4,739 feet. This portion of road is the highest pass in Alaska that is open year-round and was one of the more dangerous legs of the journey due to severe avalanche risk.

"On the Dalton Highway between Fairbanks and Deadhorse, it's an uncomfortable feeling when you see signs that tell you not to stop on this road because of avalanches. There are markers on the road every 100 yards that are way up on poles, so if an avalanche sweeps through, you can see the marker above the snow and tell emergency crews where you were swept off the road," Fred said.

Despite the possibility of life-threatening avalanches, Fred and Valerie did not overlook the opportunity to enjoy the natural beauty.

"It was beautiful. It's also pretty cool because you can see the lines down the side of the mountain where the avalanche snow falls down. We saw lots of wildlife in this pass too — musk ox, moose, wolf, wolverine and caribou," Valerie said.

Orientation and preparing for the open tundra

After braving Atigun Pass and the Ice Road, Valerie and Fred spent a day in Deadhorse prepping for the final stretch of the journey to Utqiaġvik. To preserve and protect the frozen tundra, travelers must adhere to strict environmental protocols, including attending an orientation hosted by Arctic Slope Regional Corp., the local guide company that ensures safe and ecologically conscious travel from Deadhorse to the surrounding villages.

"The guides were amazing. They respect nature. Most of them have done this on the tundra on snow machines or four-wheelers their whole life. It's just their life. However, we brought our own satellite phone, just in case," Fred said jokingly.

The orientation provided Fred and Valerie an opportunity to reflect on their upcoming journey across the tundra on the Community Winter Access Trail and served as a final checkpoint to ensure they had all the required supplies to make the dangerous drive. The purpose of the trail is to give locals and others an alternate option to transport goods and vehicles, rather than be solely dependent on extremely costly air freight or barge services.

'Caravan to Barrow is a go'

The morning of April 6, Fred and Valerie woke up to subzero temperatures and a 243-mile stretch of tundra to traverse before reaching their destination.

"It was only 243 miles, but it took us about 13 1/2 hours because there are a lot of stops. You have to go through security checkpoints and gates along the way, and the whole time you're being escorted," Valerie said.

The escorts provided walkie-talkies that allowed them to stay in constant contact with Fred and Valerie. Because the stretch of road from Deadhorse to Utqiaġvik is only open part of the year, in the spring before the rivers and lakes melt, the escorted convoys

ICE ROAD — Traversing the frozen Yukon River was part of the nerve-racking journey from Fairbanks to Deadhorse, Alaska, on the Dalton Highway, or Ice Road. "We went over this bridge that goes over the Yukon River, and the road deck is made out of wood. The river was so wide, almost as wide as the Mississippi," Sandia technologist Valerie Sparks said.

Photo courtesy of Valerie Sparks

serve as an opportunity for locals to pick up critical supplies, including new cars.

"When we were leaving Deadhorse, the guides came on the radio and they said, 'Caravan to Barrow is a go.' That was cool. That stuck out in my mind as an aha moment of the trip. We were really going to do this drive," Valerie said.

The caravan pressed on over the frozen tundra, stopping only once to fuel in a wind chill of negative 22 degrees Fahrenheit. Travelers are required to remove all waste they produce during the trip, and they are barred from venturing off the road onto the untouched tundra to ensure a minimal ecological footprint.

"The tundra is like a giant sponge. If it's not frozen and you step on it, your foot will sink into the top layer. So, it's best to travel when the tundra is frozen to avoid negatively impacting the environment. That's why you have to stay on the road with the escorts, because you can't tell where the road ends or what's on the side of the road under the snow," Fred said.

After driving 25 mph all day, through potholes and uneven terrain, Fred and Valerie safely delivered the Ford Expedition to Utqiaġvik, Alaska, the evening of April 6. They completed the 1,088-mile journey in just four days, avoiding exorbitant vehicle barge shipping costs and ensuring the Sandia staff had a safe, working GSA vehicle for daily transport to and from the Atmospheric Radiation Measurement user facility.

The cost of climate change

Fred and Valerie's trip provided a prime opportunity to see Alaska's inland beauty, enormous rivers and mountain passes, but it also provided time for reflection on how much the terrain has changed since they both began working in Alaska.

"I've been working up there so long that I've seen a lot," Valerie said. "The main road to town runs along the ocean. You used to be able to see the waves from the road, but now the road has a berm next to it to protect the road from being washed out by

the ocean. Eventually, better means of mitigation will be required to protect Utqiaġvik from coastal erosion."

Fred has also witnessed the severe and often disheartening effects of climate change in the Arctic.

"With the time I have spent in the Arctic, the three most noticeable changes I have experienced are coastal erosion from the Chukchi and Beaufort Seas, the region's permafrost layer changing and longer periods of warmer temperatures during the summer," Fred said.

In addition to monitoring these changing conditions, Sandia scientists **develop and improve regional Arctic and Earth system models** to help decision-makers anticipate further environmental changes and risks facing these isolated communities.

Road tripping, again?

"I would like to do the Dalton Highway again, but not the (Community Winter Access Trail). It's too stressful. The vehicle hits bumps and holes and wants to steer itself — you really have to focus the whole time. It's not a soft ride. It's more of a 13-hour bumping, slamming ride. It was loud and nerve-racking. It was rough," Fred said.

Valerie, on the other hand, is open to departing on the whole adventure again.

"It was an interesting drive, and I want to do it again someday," she said. "That's one of the reasons I'm still here in this group, because it's just a once-in-a-lifetime experience — full of amazing things I've never experienced before."

ADVENTURE CREW — The caravan from Deadhorse to Utqiaġvik included two guide cars and five civilian commuter cars. Each car was required to have at least two drivers, in case of emergency. **Photo courtesy of Valerie Sparks**

SLOW AND STEADY — Sandia engineer Fred Helsel and technologist Valerie Sparks traveled only 243 miles on the last day of their trip, but due to the rough tundra terrain, it took more than 13 hours. **Photo courtesy of Fred Helsel**

TOP OF THE WORLD — The town of Utqiaġvik, Alaska, sits 320 miles north of the Arctic Circle and is the northernmost city in the United States. **Photo courtesy of Fred Helsel**

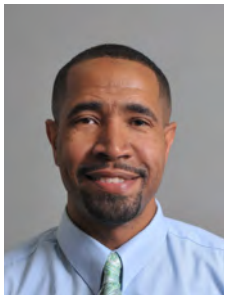
Mileposts


John Moser 25


Joel Boyer 20


Joe Burnside 20


Bill Cavanaugh 20


Christopher Collins 20


Jane Ferrizz 20


Jeff Georgeson 20


Gary Hall 20


David Ho 20


Wes Landaker 20

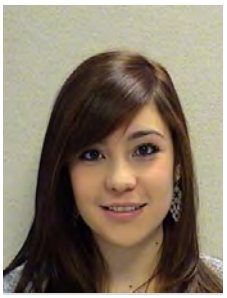

Glen Magee 20


Simon Scheffe 20


Kamilla Schwing 20


Barbara Zimmerman 20


Amanda Cox 15

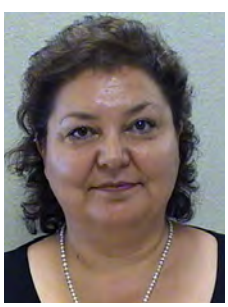

Erica Rosales 15


Khachik Sargsyan 15


Irina Tezaur 15


Loren Updegraff 15

Recent Retirees


Debra Sanchez 20

Pet drive success

HELPING FURRY FRIENDS — Researcher Elizabeth Morris sorts donations at Sandia's Advancing the Next Generation of Leadership Excellence's Homeward Bound pet drive. Employees dropped off more than 125 pounds of dry dog food, 275 pounds of wet cat food and several boxes of dog toys, blankets, collars and treats at Sandia Laboratory Federal Credit Union locations in New Mexico to help homeless pets that are waiting for their forever homes. Lap Dog Rescue of New Mexico, Animal Humane New Mexico and June's Senior Cats were among the organizations that received donations.

Photo courtesy of Advancing the Next Generation of Leadership Excellence

Dedication, curiosity earn chemist DOE Early Career Research Award

By **Michael Ellis Langley**

Although managers and colleagues had often called her work "exceptional," chemist Krupa Ramasesha was still surprised to learn she had earned a 2022 DOE Early Career Research Award.

"I am thrilled to receive this award because it will allow me and my team to focus a large portion of our efforts on expanding our research program to tackle important problems at the frontiers of photocatalysis and interfacial chemistry," she said.

Shedding light on tiny spaces

With the DOE Early Career Research Award, Krupa plans to launch an in-depth study of how interactions of nanoparticles with light drive chemistry.

"Certain types of metallic nanoparticles are characterized by very strong interactions with light," she said. "Based on the size, shape and composition of the metallic nanoparticle, light in the near-infrared or visible wavelengths can excite the so-called localized surface plasmon resonance, which is characterized by the collective oscillation of electrons in the nanoparticle."

Plasmon resonance decays rapidly by transferring energy and charge to its surroundings. When molecules are adsorbed on the surface of these metallic nanoparticles, such charge and energy transfer processes can trigger chemical transformations, like bond breakage, in the adsorbed molecules, thus initiating reactions.

"The goal of my work under the early career award will be to develop a fundamental understanding of the electronic interactions between molecules and metallic nanoparticles. These electronic interactions form the foundation for energy and charge transfer processes that immediately follow light excitation," Krupa said.

She believes this insight will help advance the field of plasmonic photocatalysis, where plasmonic metal nanoparticles are used as antennas for absorbing and channeling solar radiation to drive chemical reactions.

"There are numerous open questions surrounding the nature of electronic interactions and the mechanisms for energy and charge transfer between molecules and nanoparticles," Krupa said. "We will address these questions using a combination of cutting-edge X-ray and infrared spectroscopies, which can monitor the transfer of charge and energy with site-specificity on the natural femtosecond to picosecond (one quadrillionth to one trillionth of a second) timescales characteristic of electronic and atomic motion."

Finding inspiration in her parents

Krupa's curiosity and enthusiasm for her research, and her earliest inspiration, come from childhood.

"My parents are both chemists and academics," she said. "They have had decadeslong successful research and teaching careers — my father, S. Ramasesha, in theoretical chemistry and my mother, Sheela Ramasesha, in materials chemistry — so I was exposed to research life very early on. Their excitement for science is infectious and their knowledge vast; any question I had as a kid about the world around me would turn into an exciting discussion that spawned more questions and led to a deeper understanding. I learned various science and math concepts from them through these spontaneous conversations and by spending time in their labs and offices."

Krupa said she witnessed their research triumphs, setbacks, hard work and perseverance firsthand, fueling her own research career without any romantic notions of what success in science is and what it takes to get there. She often reflects on and draws from what she observed from her parents as she thinks of her own career.

"My parents are fantastic examples of having a successful research career as well as a fulfilling personal life, and words cannot express how grateful I am for their inspiration and example," Krupa said.

AWARD-WINNING — Krupa Ramasesha earned a 2022 DOE Early Career Research Award.
Photo by Srihari Narasimhan

Forging ahead and forging a new future

Krupa said she is as excited and fascinated by science now as she was as a teenager, thanks in large part to those who helped her along the way.

"I am indebted to my undergraduate, graduate and postdoctoral research advisers who trained me scientifically and technically to take on research challenges in my field," Krupa said. "I am thankful to my past and present colleagues, particularly my team of postdocs, technologists and collaborators, for all their hard work and dedication, as well as to Sandia management that helped me commence my research program, and more recently, advised me through the proposal writing process for the early career award."

But Krupa relies most on her team at home.

"My husband, Srihari Narasimhan, and our two daughters bring immense joy and meaning to my life," she said. "I am incredibly grateful to my family for their love

and support, for providing the necessary perspective and for being sounding boards for new ideas."

Krupa believes this exciting new research path will not only be professionally fulfilling but will also provide an opportunity to help address the climate crisis, in some small way, for the sake of her kids and their generation.

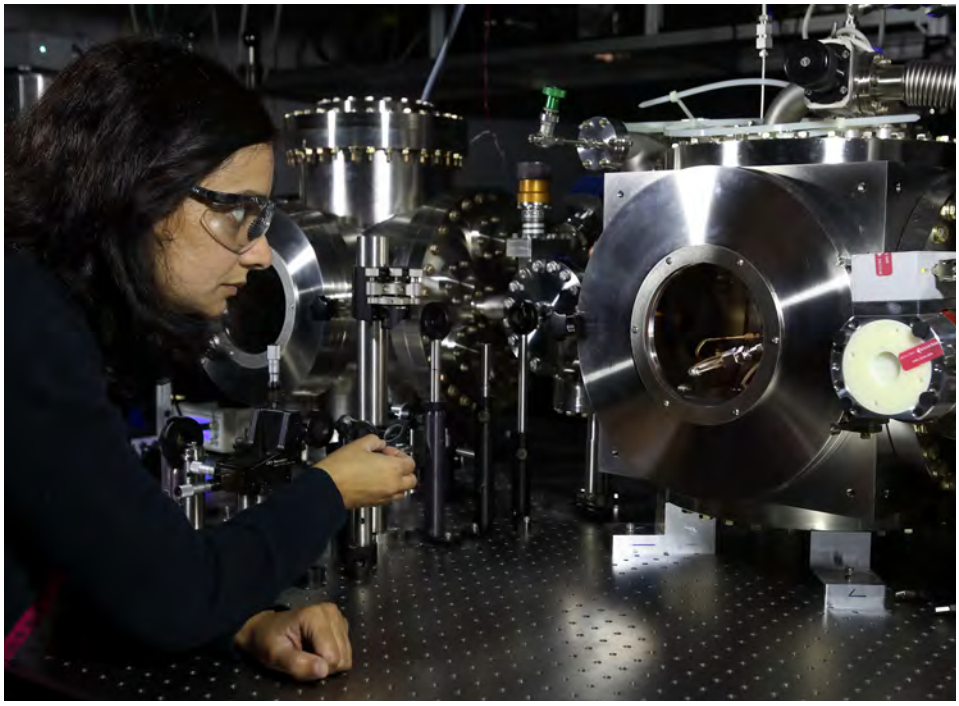
"It would be terrific if we are successful in resolving the mechanisms of charge and energy transfer between metallic nanoparticles and molecules, as this could inform how tailoring the properties of nanoparticles and light excitation can selectively drive certain chemical reactions," she said. "Many steps down the line into the future, this could help alleviate the considerable dependence on fossil fuels for driving industrial chemical reactions at high temperatures. The long-term aspiration is to provide a scientific knowledge base required to scale up plasmonic photocatalysis such that solar radiation can be efficiently harnessed to drive large-scale chemical reactions."

Krupa's project, Unraveling the Ultrafast Chemical Dynamics Governing Non-Equilibrium Molecule Nanoparticle Interactions, is now fully funded for the next five years by the DOE Early Career Research Award program.

DOE Early Career Research Awards

The DOE Office of Science has selected four Sandia researchers to receive **Early Career Research Awards** this year. Krupa Ramasesha, Pete Bosler, Tim Proctor and Andrew Mounce will receive up to $500,000 per year for five years to advance their research. This summer, Lab News will profile each researcher.

The program, now in its 13th year, is designed to provide support to researchers during their early career years, when many scientists do their formative work. This year, the DOE awarded 83 scientists nationwide, including 27 from national laboratories.



CHEMIST SUCCESS — Krupa Ramasesha uses lasers in her work to understand the edges of physical chemistry. **Photo by Dino Vournas**

Hands-on STEM

HMTech takes place in person, first time since pandemic

By **Manette Newbold Fisher**
Photos by **Tyrese Green**

Local students participated in hands-on STEM activities and learned about science and engineering careers during Sandia's 36th annual HMTech program at Albuquerque High School. During three Saturdays in June, middle school and high school students conducted chemistry experiments, worked with circuits and microcontrollers, learned about 3D printing and readied robots for competition.

Volunteers also led classes in personal finance, everyday math and STEM careers where instructors gave students tips on how to succeed in school and apply for jobs.

HMTech began in 1986 as an after-school program led by a group of Black Sandia employees who wanted to inspire Black students to pursue careers in science, technology, engineering and math. Ten years later, HMTech evolved into a summer program sponsored by the Labs. It is open to all students entering grades 6-12 and hosted by Sandia's Black Leadership Committee and Community Involvement team.

CHEMICAL BONDING — Sandia chemical engineer and volunteer LaRico Treadwell, left, works with his son during a chemistry class. Some families participated in HMTech.

INTERACTIVE EXPERIMENTS — Sandia chemist and volunteer LaRico Treadwell, left, helps students make liquid nitrogen ice cream during HMTech.

SUMMER SCIENCE — Sandia volunteer Erin Akinnikawe, an electrical engineer, assists a student debugging Python code to program a circuit playground microcontroller to turn on LEDs.

FORMING NEW QUESTIONS — Sandia chemist and volunteer LaRico Treadwell engaged with students in HMTech's chemistry class with indoor and outdoor activities.

STANDING BACK — Students learned about chemical reactions by launching Mentos volcanoes during HMTech.

REACTIVITY — Sandia chemical engineer and volunteer LaRico Treadwell leads a class during the 36th annual HMTech program.

SKILL BUILDING — A student in the HMTech program works on a project during a chemistry class.