SANDIA LABNEWS
PUBLISHED SINCE 1949

Vol. 76, No. 5, March 7, 2024

Celebrating women who ignite change Page 10



# Propelling 3D printing into the future


**PIECE BY PIECE** — Samuel Leguizamon, left, watches as Alex Commisso stretches 3D material that they printed using Selective Dual-Wavelength Olefin Metathesis 3D-Printing, or SWOMP. **Photo by Craig Fritz**

## *Printing stronger materials five times faster*

*By* **Kim Vallez Quintana**

3D printing has changed the world. It's allowed the aerospace, medical, automotive, manufacturing and many other industries to customize parts and prototypes in ways they never could before. It has drastically increased flexibility and cost effectiveness while reducing waste and production time. But many 3D-printed materials aren't the strongest.

A team of chemists and materials scientists at Sandia hopes to change that.

They've developed a new printing

— CONTINUED ON PAGE 5

# Living, racing and inspiring with Type 1

## *Sandia engineer won't be going to the Olympics … yet*

*By* **Maggie Krajewski**

The day of the race, Sofie Schunk laced up her shoes knowing it wasn't her day to break any records. But 8-year-old Ila Gray was there on the sidelines waiting to cheer Sofie on with a hand drawn sign that read, "Go Sofie Our Type 1 HERO."

Sofie was in Orlando to compete alongside dozens of full-time professional runners, all vying for a seat on the 2024 U.S. Olympic Marathon Team. And as expected, it wasn't her day. The women's qualifying time is 2:26:50, Sofie finished in 3:22:26, 117 out of 117 finishers. Or as she describes it, "dead last."

"It was my slowest marathon," said Sofie, a Sandia systems engineer.

Sofie has been running marathons since 2016 and living with Type 1 diabetes since 2008.

— CONTINUED ON PAGE 6

**IN STRIDE** — Engineer Sofie Schunk does strides following her run with the Dukes Track Club near the University of New Mexico campus. Sofie competed in the Olympic Trials for the marathon in February 2024. **Photo by Craig Fritz**

SANDIA LAB NEWS
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
**Ray Johnson, Production** rbjohns@sandia.gov
**Craig Fritz, Photographer** cvfritz@sandia.gov
**Michael Langley, California Contact** mlangle@sandia.gov

**CONTRIBUTORS**

**Michelle Fleming** (milepost photos, 505-844-4902), **Neal Singer** (505-846-7078), **Kristen Meub** (505-845-7215), **Troy Rummler** (505-284-1056), **Meagan Brace** (505-844-0499), **Mollie Rappe** (505-288-6123), **Skyler Swezy** (505-850-2063), **Kim Vallez Quintana** (505-264-1886), **Kenneth Vigil** (505-537-1528), **Luke Frank** (505-844-2020), **Michael Baker** (505-284-1085) **Maggie Krajewski** (mkrajew@sandia.gov), **Valerie Alba** (vnalba@sandia.gov), **Lea Blevins** (925-294-1232)

*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



**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 the Lab News editor at labnews@sandia.gov.

# Arctic fiber: Using fiber optics to study seafloor permafrost

**ICE PIMPLE** — A permafrost-created pingo or "ice pimple" in the North Slope of Alaska. Sandia scientists have been using a fiber optic cable to study permafrost in the Arctic seafloor to improve the understanding of global climate change and found a similar structure under the seafloor. **Photo by Christian Stanciu**

*By* **Mollie Rappe**

The Arctic is remote, with often harsh conditions, and its climate is changing rapidly — warming four times faster than the rest of the Earth. This makes studying the Arctic climate both challenging and vital for understanding global climate change.

Sandia scientists are using an existing fiber optic cable off Oliktok Point on the North Slope of Alaska to study the conditions of the Arctic seafloor up to 20 miles from shore. Christian Stanciu, project lead, presented their latest findings in December at the American Geophysical Union's Fall Meeting in San Francisco.

Their goal is to determine the seismic structure of miles of Arctic seafloor. Using an emerging technique, they can spot areas of the seafloor where sound travels faster than on the rest of the seafloor, typically because of more ice. They have identified several areas with lots of ice, said Christian, a geophysicist.

The scientists also used the cable to determine temperatures over the stretch of seafloor and monitored temperature changes over seasons. These data, unlike any collected before, were inserted into a computer model to infer the distribution of submarine permafrost, said Jennifer Frederick, a computational geoscientist.

"One of the innovations of this project is that we can now use a single fiber to get acoustic and temperature data," Christian said. "We developed a new system to remotely collect both types of data using one fiber strand. We're getting some interesting results."

## Permafrost and bouncing light

Like leftover roast turkey sitting in the back of the freezer since Thanksgiving, Arctic permafrost is a banquet just waiting to be thawed. Specifically, as the once-living matter that was frozen during the last ice age thaws, microbes begin to digest it and produce waste gases such as methane and carbon dioxide, Jennifer said. Scientists are studying just how large a microbial banquet lies frozen in the Arctic and how large of an impact those gases could have on the global climate.

To study permafrost on the Arctic seafloor, the researchers used pulses of laser light shot down a submarine telecommunications fiber optic cable buried off the coast of Alaska, running north from Oliktok Point. Tiny imperfections in the cable caused light to bounce back to a sensor system. By capturing this light at two wavelengths, or colors, and comparing them, the researchers could determine the temperature of the cable every yard, Jennifer said. This is called distributed temperature sensing.

**BIG THAW** — Sandia researcher Jennifer Frederick explores a river in the North Slope of Alaska. Studying permafrost in the Arctic seafloor can improve our understanding of global climate change. **Photo by Christian Stanciu**

By looking at light of a different wavelength, the researchers could detect when the cable had been strained by a passing sound wave. This so-called distributed acoustic sensing provided information about the structure of the seafloor to depths of one to three miles, Christian said.

Using this method, the scientists believe they have identified the bottom of the seafloor permafrost at around a quarter of a mile deep. They also found another area with unusually large amounts of ice, possibly consistent with a pingo or "ice pimple," a domed hill formed by ice pushing upwards, he added. The data analysis for the measurements was done principally by Sandia intern Brandon Herr.

"The fact that we can monitor the temperature continuously, we can now pick up changes from year to year and season to season," Jennifer said. "We're specifically looking for unexplainable warm spots. We think we'll be able to see areas of seafloor seeps — somewhat like springs coming out of the ground, except on the seafloor. We're interested in them because they're carriers of deeper, carbon-rich fluids and are an indication of warming and change."

## History and innovations

Sandia has been collecting climate data from northern Alaska for more than 25 years. The current research project started about a year ago and builds off prior work on the same fiber optic cable by Sandia geophysicists Rob Abbott and Michael Baker. This project is funded by Sandia's Laboratory Directed Research and Development program.

One recent innovation from Christian's team is a fully operational system that allows near-real time remote data collection. This minimizes time and cost of travel to Oliktok and the risk of losing data when the system is unattended, Christian said. Acoustic and temperature data cannot be collected at the same time, but one or the other now can be collected continuously.

One challenge the team solved during the first year of the project was determining how to calibrate temperature data from the fiber optic cable, Jennifer said. Typically, distributed temperature sensing systems are built with self-check systems such as fiber that doubles back on itself for redundancy or with built-in thermometers. However, since the team is using a telecommunications dark fiber, they needed computational models to validate the seasonal temperature changes they detected. The data analysis for this was done principally by Sandia intern Ethan Conley.

**ICE TEAM** — From left, researchers Michael Baker, Rob Abbott and Christian Stanciu, stand in front of the iced over Beaufort Sea on the North Slope of Alaska. By sending laser pulses down a fiber optic cable under the seafloor, the researchers study permafrost in the seafloor. **Photo by Christian Stanciu**

Jennifer uses the data from the distributed temperature sensing and the results from the distributed acoustic sensing modeling to provide constraints to a geophysical modeling code developed by Sandia. The code models liquids and gases flowing through soils underground. Jennifer uses this code to model 100,000 years of geologic history for the studied stretch of Arctic seafloor, including the average temperature of the most recent ice age and how much the sea level has risen. The results of the model are maps of the current distribution of submarine permafrost.

Limitations of the interrogator system the team uses, including the power of the laser and sensitivity of the sensors, keep the scientists from collecting data more than 18-25 miles offshore, Jennifer said. With improvements to the system, she hopes to push the distance out farther.

"This project has many different pieces," Jennifer said. "I'm looking at temperature and Christian is looking at acoustics to get a subsurface model. Really you need all of these pieces to say something about the larger picture of the current distribution of permafrost and whether we are seeing changes like seeps and how that plays into the larger greenhouse gas emissions picture. Being able to use new tools and push them to their extreme to see what we can learn is really cool."

# Researchers develop tantalizing method to study cyberdeterrence

## *Experimental war gaming provides insightful data for real-world cyberattacks*

*By* **Trina West**

In Greek mythology, Tantalus so angered Zeus with his treachery that his punishment was to go thirsty and hungry while standing in an always receding pool of water with bountiful fruit trees just above his reach. His fate serves as a reminder to humanity that foolish actions can lead to unpredictable and enduring consequences.

At Sandia, the name Tantalus is associated with an experimental multiplayer online war game used to study different conditions within cyberdeterrence strategy. More importantly, the game is a human research study to gather data about how people's decisions during threatening situations can impact national security.

"We're interested in understanding the theory of cyberdeterrence — the notion that the threat of cyberattacks can modify or inhibit the actions of others," Jon Whetzel, the lead online game designer, said.

To learn more about the human element of cyberdeterrence, researchers pursued increasing Sandia's experimental war-gaming capabilities, and the Program for Experimental Gaming and Analysis of Strategic Interaction Scenarios created Tantalus. As part of the PEGASIS portfolio, Tantalus was a three-year Laboratory Directed Research and Development project on cyberdeterrence funded through the Energy and Homeland Security Investment Area Team. The project recently ended, and the team published its preliminary findings in September.


**TANTALUS** — As a nod to its namesake, the online game simulates how success or failure is within a player's reach. **Screenshot of Tantalus**

### Combining scientific rigor with the art of war game design

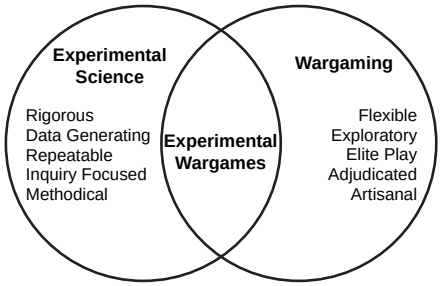
Tantalus is unlike most war games because it is experimental instead of experiential — the immersive game differs by overlapping scientific rigor and quantitative assessment methods with the experimental sciences.

"We consider real-world problems," said systems research analyst Jason Reinhardt. "And the war games are a laboratory where we can experiment on deterrence problems and understand how they change under different circumstances."

Tantalus is a three-player war game where players navigate between building and defending their nation. Players act as the leader of a hypothetical country with a mission to increase key "metrics" in their country's mining, infrastructure and manufacturing while fending off attacks from rival countries. The game consists of 12 to 18 randomly selected rounds, with four phases per round: Planning, Threats, Revision and Execution. Players choose to influence or deter each other by force (kinetic, cyber or nuclear) or engage in espionage.

"We wanted to have the players strive for something that could be taken out of reach by the other players," Jon said.

During the game, players might threaten to conduct a cyberattack, also known as cyber brandishing. However, in cyberwarfare, revealing a threat can decrease its effectiveness and render the threat powerless, causing a capability-communication tradeoff. Researchers analyzed the game's data to see how this tradeoff impacted the players' strategies and ability to manage cyberattacks, including the efficacy of threatening opponents.




**EXPERIMENTAL WAR GAMING** — "We think about experimental war games at the intersection of experimental sciences and war gaming," said principal investigator Kiran Lakkaraju. **Illustration by Jason Reinhardt**

"We modify game conditions by altering the available threats to player groups. We examine the gameplay across different conditions to see if players favor certain deterrence measures and how other players respond to those threats," Jon said.

Players must earn three victory points to win, and there can be multiple winners — or no victors at all.

### Vanguards of experimental war gaming

The game developers are taking a novel approach because there is little theoretical data about cyberwarfare. The team created Tantalus to study aspects of cyberdeterrence theory that are difficult to observe due to a lack of established precedence.

"Cyberweapons are very tantalizing," Jason said. "People are constantly talking about cyberwar and cyberattacks, and it's very tempting to try and think about that in the deterrent space. But we don't understand it well enough to have a solid set of theories about it."

Simulating war games in a laboratory environment allowed researchers to answer questions about the impacts on strategic stability and international and national security. The challenge was designing the type of

game that would enable researchers to collect and analyze data about human behavior within a well-designed cyberworld.

"It's exciting because it is bringing all these different facets like game developers to data scientists to machine learning folks," Jon said.

Researchers spent the first year studying cyberdeterrence and partnering with cybersecurity experts and academics from the University of Illinois, Purdue University and the University of California, Berkeley. Then, they designed a working prototype of the game before releasing Tantalus to the public for experimental gameplay. The result was 394 games played with over 1,000 players. The data collected will allow Sandia researchers to study parts of cyberdeterrence theory that are otherwise difficult to observe.

"Some of the ideas we've been developing are being taken up by other organizations and academic institutions," principal investigator Kiran Lakkaraju said. "We're really pushing forward the field of war gaming and are on the cutting edge at Sandia."

Tantalus is still available for all to play. The game was picked as a finalist to compete at the Serious Games Showcase & Challenge held at the I/ITSEC 2023 conference in Orlando, Florida, from Nov. 27 to Dec. 1.


**HOW TO WIN** — "Players reach for victory by competing for the highest metric value. **Graphic by Brent Haglund**

# 3D printing

CONTINUED FROM PAGE 1

process that prints stronger nonmetallic materials in record time, five times faster than traditional 3D printing.

"It opens up a whole new world of what you can build and what 3D materials can be used for," materials scientist Samuel Leguizamon said.

He led the team that developed SWOMP, which stands for Selective Dual-Wavelength Olefin Metathesis 3D-Printing. As indicated by its name, it uses dual-wavelength light, unlike the traditional printing process.

## How 3D printing works

Traditionally, vat 3D printing is accomplished by irradiating a vat of photosensitive liquid resin in a desired pattern.

As the resin is exposed to light from beneath the vat, the resin cures and hardens into a polymer layer. The cured polymer is then lifted, and a new pattern is projected beneath to cure subsequent layers.

One challenge: As the polymer cures, it adheres to the previous layer and to the bottom of the vat. After each layer, the cured polymer must be slowly peeled from the vat to prevent damage, significantly slowing down the 3D printing process.

Fellow creator Leah Appelhans said it's kind of like baking cookies. "After you bake the cookies, you have to let them cool. If you were to try to peel the warm cookie off the cookie sheet, it's squishy and it breaks apart. The same thing would happen with a 3D printer if you tried to quickly print each layer. Your work would get deformed."

Samuel, Leah, former Sandian Jeff Foster and polymer scientist Alex Commisso came up with a way to cool the "cookies" quicker.

## UV and blue light

The key is combining two lights. In this case, ultraviolet and blue light.

The team took inspiration from a technique known as continuous liquid interface printing along with a printing approach using dual-wavelength light for acrylic-based polymerizations.

With it, they created SWOMP.

"You are still printing layer by layer, but you are using a second wavelength of light to prevent polymerization at the bottom of the vat. So it doesn't adhere to the bottom," Samuel said. "That means you can lift the cured polymer part more quickly and speed up the printing process significantly."

## Making 3D materials stronger

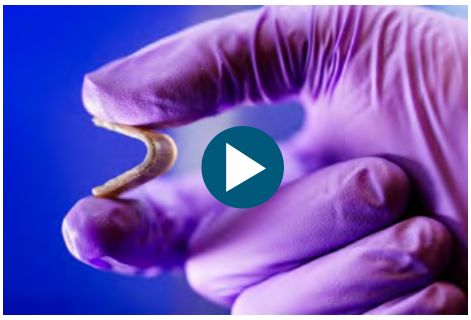
But this new process isn't just about efficiency. It's about making 3D-printed materials stronger and more versatile. Most vat-polymerization-printed materials are acrylic-based, not the strongest material.

"It's really hard to use these materials in things like aircraft and space and aerospace and automotive. They are very harsh environments," Sandia licensing executive Bob Sleeper said.

This team turned to the material dicyclopentadiene, which is commonly used in the production of paints, varnishes and flame retardants for plastics. They were able to develop a way to polymerize it more rapidly with light so that it can be used more efficiently in 3D printing.

"We changed building blocks of the materials from acrylic-based to olefin-based," Samuel said. "Which lets us print materials that are a lot tougher."

"That is the beauty of what they are doing," Bob said. "You have very high-quality plastic parts that are made very precisely by using some light in a very novel way."



**A NEW WAY OF PRINTING** — Alex Commisso flexes a piece of 3D-printed material with varying softness achieved by Selective Dual-Wavelength Olefin Metathesis 3D-Printing, or SWOMP. **Video by Craig Fritz**

## Opening a new world of 3D printing

This team hopes their new printing process will open the world of 3D printing.

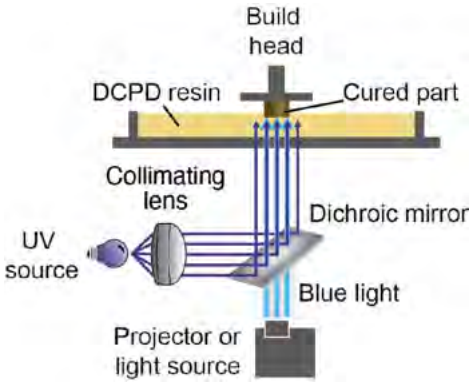
While the project was initially funded through a rapid three-month Exploratory Express program, it's now funded by a Sandia technology maturation program.

"What we are trying to do is build the toolbox of materials available," Leah said. "We want designers, researchers, engineers to be able to select the type of material they want to use."

One day, they hope to see these 3D-printed parts in rockets, engines, batteries, maybe even in fusion applications. Samuel said they're already talking with researchers at Lawrence Livermore National Laboratory to explore applications. "It turns out that monomers are already used in fusion components. You don't usually think of a polymer used in fusion, but it's really cool and exciting potential."

The team also sees a world where 3D printing can be done more easily in remote areas. "We're looking at locations where machinery and parts are not readily available; like in space, on the moon or in the Middle East at a U.S. military base," Bob said. "You can bring with you some lightweight materials and make whatever you need on the spot."

Samuel, who grew up in the small town of Wagener, South Carolina, is also thinking of applications that could help closer to home.




**A NEW WAY OF PRINTING** — SWOMP, or Selective Dual-Wavelength Olefin Metathesis 3D Printing, uses two wavelengths of light simultaneously to change the way certain materials are 3D-printed.

**Graphic courtesy of Samuel Leguizamon**

"I have horses. I grew up in a rural area, my dad was a farrier, so I'm thinking of ways to make horseshoes for racehorses. They have to be impact-resistant, but by changing the material properties, stress can be better spread out, and impact in the right space on the hoof. You could think of it as insoles for horses."

The possibilities are endless.

"I think what attracted me to chemistry in the first place is the potential to make something that has never existed before," Leah said. "The fun thing about 3D printing is that you apply that chemical knowledge to something that has a very concrete outcome. Something you can see and hold in your hands."

## Chemistry and collaboration at its finest

The team said this project is a perfect example of how Sandia brings together people from different backgrounds to collaborate.

Samuel Leguizamon brought photochemistry experience from his doctorate work; Leah Appelhans brought expertise in developing methods for additive manufacturing of thermosets; and Jeff Foster had a background in this particular type of polymerization.

"It created something that is far greater than any individual person working on their own would have been," Leah said.

The project began in early 2021 when Leah and Sam, both immersed in a tech maturation project funded by NNSA, confronted the limitations of conventional resin printing. Their collaboration sparked a pivotal question: Could there be a faster way to bring their ideas to life? Drawing from his experiences in Timothy Scott's lab, Sam realized the key was to bring a second wavelength of light into the process.

As fall arrived in 2021, the project gained momentum with the addition of Foster. Foster's expertise in synthesis and polymer chemistry proved invaluable as they set out to validate the feasibility of their concept. Together, they achieved accelerated printing rates and enhanced thermomechanical performance using specialized resins.

By fall 2022, the team expanded to include Adam Cook and Devin Roach. Their expertise in system evaluation and characterization played a crucial role in building a robust, modular dual-wavelength printer. Under Sandia's technology maturation program, they transformed ideas into tangible results.

In 2023, Alex Commisso joined the team, bringing a focus on 3D printing monomer systems. Alex's expertise allowed the team to expand their available library of materials and dual-wavelength inhibitory systems. Together, they stand at the forefront of innovation, poised to shape the future of additive manufacturing.

Innovative Methodologies

# Olympics

CONTINUED FROM PAGE 1

## The diagnosis

The latter came down her sophomore year of high school. Always an active kid, Sofie played soccer and ran track, but after a family vacation started experiencing weird symptoms. First it was a head-to-toe rash, next she was losing weight with no explanation, coupled with depleting energy, Sofie was suddenly falling asleep in class and feeling constantly exhausted.

"My mom took me to the doctor, and they said maybe I was just growing," Sofie said. "But they did blood work and when my labs came back the doctor called my mom panicked and was like, 'get her to the hospital now!'"

The doctor was worried Sofie was in diabetic ketoacidosis which is what happens when the body doesn't have enough insulin to allow blood sugar into the cells to use as energy. This causes the liver to break down fat for fuel which produces acids called ketones and when too many ketones are produced too fast, it can be toxic.

Sofie's blood sugar was 680 milligrams per deciliter. Normal blood sugar range should be within 90 to 130.

"Initially, after learning I was Type 1, I felt relieved to finally have a reason for why I was feeling so terrible," Sofie said. "I went home that night and ate a pear, took my insulin and my blood sugar still went up to around 400."

"That's when it hit me — shots multiple times a day, monitoring my blood sugar, this was the rest of my life," Sofie said. "I just started to cry."

## Living with Type 1

Sofie said the first year after the diagnosis was the hardest. She had always been shy but now she had to take shots in front of people and started gaining weight — which she knows now was healthy — but the adjustment was tough.

She continued playing soccer and running track as a sprint and mid-distance runner, but at much slower speeds.

In the fall of 2010, Sofie started at

Marquette University where she continued playing NCAA Division I soccer as the team's goalie for four years. It was here where she met other athletes living with Type 1 diabetes.

"I met Patrick Maag, who was on the track and cross-country team at Marquette," Sofie said. "He was diagnosed as a child and talked to me about what devices he used, how he managed his diet, when he'd take his insulin and how he'd fuel before and after exercise."

Maag encouraged Sofie to pursue a degree in exercise science where she met John Kilka, a faculty member, who had been diagnosed with Type 1 diabetes later in life.

"He had run an Iron Man before he developed diabetes and then again after he was diagnosed," Sofie said. "Patrick and John showed me that running long distances with Type 1 was possible."

## Going the distance with Type 1 diabetes

And so Sofie started running.

Encouraged by John, Sofie joined the "Running with the President" run club at Marquette. But learning to navigate longer distances while managing her diabetes wasn't without its challenges.

"The first time I ran more than 10 miles, I had to stop at a gas station and explain to the attendant that I was diabetic, and my blood sugar was dropping, but I didn't have any money, so they ended up giving me a Gatorade," Sofie said. "I went back and paid later but the experience really opened my eyes to how prepared I needed to be for everything."

In 2016, Sofie ran her first marathon.

"I had never planned on running a marathon, but I was training with a group that was running the Lakefront Marathon in Milwaukee, and they encouraged me to sign up for my first half, which I did and had such a great time," Sofie said. "And they were like, 'you should just run the full,' and so I did."

Sofie ran a 2:52 and placed third.

"I had a really good day," Sofie said. "I discovered my love of distance running and had mastered my blood sugar. I was ready for the next one."

But like all things in life, they weren't all good days. Although as Sofie explains, each setback was set up for comeback.

"I ran Boston in 2018 but I overtrained and kept getting stress fractures," Sofie said. "The day of the race was rough. I didn't do great, but I learned an important lesson about training and just how humbling running a marathon can be."

## Running toward the Olympics

The next few years brought a move to San Diego and then back home to Albuquerque. More injuries and setbacks, a marathon personal best, a break from long distances, a global pandemic and then a return to long distance.

In January of 2023, Sofie ran a 1:16 half marathon, shaving four minutes off her previous record of 1:20.

"I texted my coach and asked what that translates to in marathon time," Sofie said. "And he told me, 'I think you could qualify for trials,'" which began the journey to break the 2:37 qualifying time, requiring a 12-minute record from her previous best.

Sofie and her coach put a plan in place and started training. This time for the Olympic Trials.

In October, Sofie ran a marathon in New York but missed the qualifying time by six minutes.

"I was disappointed. I had a perfect training block and during the race I felt great until mile 18 or so, and then I started cramping," Sofie said. "My blood sugars were really high and so after the race, I had to go back to the drawing board with my endocrinologist and medical team."

Sofie ended up filing a Therapeutic Use Exemption so that she could use insulin during competitions. Insulin is currently a banned substance for professional athletes, even for Type 1 diabetics like Sofie.

Two months later Sofie ran the California International Marathon where she qualified for the Olympic Trials running a 2:36:22. Another personal best by six minutes.

**POST-RACE CELEBRATIONS** — Sofie Schunk shares coffee with runners Sean Abeyta, left, and Brett Vinegar, following a group run by the Dukes Track Club on Jan. 26. Her friends gifted Sofie with a candy cane gift of Fireball, a tradition in the group, for to celebrate after the race. **Photo by Craig Fritz**

## The Olympic Trials

In the week leading up to Orlando, Sofie had been dealing with on-going shin pain that she was hoping would resolve itself. But the night before the race, still in pain, Sofie found herself almost in tears wondering if she should even start the race, let alone try to finish.

"I talked to my friend who coaches professionally and asked what I should do," Sofie said. "He reminded me I had nothing to lose. Worst case, I would be in a lot of pain and wouldn't be able to finish."

And then there was Ila, the 8-year-old girl waiting to cheer Sofie on with her handrawn sign, and so many others living with Type 1 diabetes that had reached out to Sofie, their Type 1 hero, who believed in her and were excited to watch her run.

On race day, Sofie wrote in an Instagram post that she "celebrated the first step in a dream, lining up with the best runners in the U.S. after a year of work and dedication," and she ran.

"It may have not been my day to race against those competitors, but it was my day to show up, finish and inspire other kids, parents and anyone living with diabetes that we don't have to let this disease stop us," Sofie said. "We can go out there with grace and try even if we don't always get the outcome we want. We can't quit."

Sofie won't be going to the Olympics quite yet. But if her story tells us anything it's that her "slowest marathon ever" is likely just the kickoff to her next personal best.

# Building effective leaders from the ground up

By **Maggie Krajewski**

Like so many in the workforce, Michele LaMontagne has experienced good leaders and bad ones.

"Leadership can make such a big impact, not just at work, but in your life," Michele said. "When I think about the great leaders I've had and have, I think about how it's affected my life at work and at home. I'm happier."

Leadership makes a difference. And Michele and her team are the driving force in building a leadership ecosystem at Sandia to help build effective leaders and strong teams.

Currently Michele's group is focused on level-one managers at the Labs.

"Volumewise, this is the largest group of leaders at Sandia," Michele said. "L1 managers are at the frontlines with members of our workforce. This is where we see the biggest opportunity to influence not just the work we do, but also to build future leaders and develop our talent pipeline."

Previously level-one managers at Sandia took part in a four-day intensive training, but as a manager herself, Michele saw the need for more continuous development.

"It's hard to learn everything you need to as a new manager or team lead in just four days, so we rebuilt the program, now called the Leadership Compass, which is an eight-week asynchronous learning program where we focus on certain topics and activities each week," Michele said. "We also created the L1 Odyssey offered after managers complete the Leadership Compass. This is a six-month program where cohorts meet for four hours every other month to learn about various leadership topics."

## Leadership styles

Before Sandia, Michele worked in the private industry for 18 years and before that, eight years as an Aircraft Maintenance Officer for the United States Air Force before transitioning to the New Mexico Air National Guard where she served for 23 years, totaling 31 years of service. These experiences exposed Michele to two very different styles of leadership hierarchy.

"My industry job had three levels of leadership in the company, people operated in self-directed work teams with a leader who wasn't called their manager but rather a business coach," Michele said. "Coming into that from the military, which has a very hierarchal structure, really expanded my thinking of what was possible and the challenges that existed."

For Michele, both styles have a place depending on the needs of the organization or team, but critical to any style is having a strong foundation. And for Michele, that strong foundation starts with building up those frontline managers.

"Where I see leaders struggle is when they pick one type of philosophy and try to force it to work in every situation," Michele said. "I'm not usually a fan of directive leadership, I prefer a more collaborative and mutually supportive relationship, but they both have a place. For example, if you're in a situation where you have an aircraft that has a problem and someone needs to make a call ASAP or they're going to miss some critical deadline, leaders need to be able to step in, direct and say, 'this is what we're going to do.'"

"Effective leaders need to be able to shift fluidly between who they are as managers and people and what is needed in specific situations," Michele said.

And while Michele and her team's work is currently focused on training and development for level-one managers, the long-term goal is to build up leadership for all.

"Big picture, we want to create a leadership ecosystem that everyone at Sandia can be part of," Michele said. "We know good leadership increases retention and engagement — so what if we could help everyone at the Labs, not just managers, become strong leaders?"

**LEADERS OF LEADERS** — Talent management manager Michele LaMontagne leads a group that has designed two intensive programs, Leadership Compass and L1 Odyssey, that equip level-one managers to guide their teams effectively. **Photo by Craig Fritz**

## Building leadership at Sandia

Sandians looking for more information on leadership training and talent development, please visit the internal talent development site.

# Sandia partners with Alabama A&M to open AI cage

*By* **Sophia Horowitz and Breanna Gallegos-Schnedar**

Nestled on the Alabama A&M University campus lies a state-of-the-art facility that allows faculty and students to conduct groundbreaking research and analyze the intelligence of artificial entities. On Nov. 28, AAMU and Sandia cut the ribbon on the university's new artificial intelligence cage to conduct drone and robotic AI research.

This project is the latest in a partnership with the historically Black university. The Labs began working with talent at the university in 2022 through Sandia's **Securing Top Academic Research and Talent at Historically Black Colleges and Universities program**, known as START HBCU.

Steve Gianoulakis, senior manager of the autonomy and unmanned systems department, serves as the deputy campus executive on behalf of Sandia for AAMU. In this role, Steve works with Sandia executives and AAMU faculty to establish institutional relationships, research collaborations and talent pathways for underrepresented minority students. The AI cage is a milestone toward furthering AI research.

"AAMU has built an AI cage as a tool to help with the development of autonomous algorithms that are based on artificial intelligence for the control and application of small uncrewed systems. The cage was based on a similar model at Sandia. The Sandia unmanned aircraft systems team provided AAMU the full design package to facilitate their recreating the system," Steve said. "The AI cage will help the development of more effective ways to steer and use drones to perform a variety of tasks, like help develop technologies to defend against drones. Drones have become the largest threats to sensitive facilities."


**REACHING NEW HEIGHTS** — START HBCU partners, Alabama A&M University faculty and students cut the ribbon to new artificial intelligence cage in November.

**Photo courtesy of Alabama A&M University**

The facility allows for students to address real-world challenges and develop adaptable, automated drone systems and vehicles.

"The AI cage is a great facility that is used by AAMU faculty and students to conduct drone and robotic AI research in a controlled, safe environment." said Andrew Scott, chairman of the **AAMU Electrical Engineering and Computer Science Program** and interim director for the **RISE Foundation**, the contracting arm of the university. RISE stands for research, innovation, science and engineering.

For more information about employment and internship opportunities, visit **START HBCU Institute**, or reach out to START HBCU recruiter Sheila Lewis or Sandia Deputy Campus Partnership Manager Ben Brodsky, who is local to the AAMU campus engaging with faculty and prospective students.

# Retired scientist's influence still felt at Sandia today

*By* **Kenny Vigil**

Many employees in Sandia's Explosive Components Facility probably don't realize the contributions one long-retired scientist has on their work each day. Even though she retired more than 15 years ago, Anita Renlund's work at Sandia is having a lasting impact on both the mission and people.

Renlund helped design the Explosive Components Facility, including the reaction dynamics lab, where she performed work. Employees she played a role in hiring are still working at Sandia, some in the programs she helped establish.

Those who worked with Renlund say her contributions to Sandia can be broken down into two main areas: science and people. "She's a brilliant scientist," said Alex Tappan, a distinguished member of Sandia's technical staff in the explosive technologies group. Renlund's work focused on understanding the chemical dynamics of the very first instant of explosive initiation. "That was really what she loved: the initiation phenomena that involved the first nanoseconds of an explosive reaction. She loved being in the laboratory doing hands-on work," Alex said.

**LASTING IMPACT** — Even though she retired in 2008, Anita Renlund's contributions to explosives research still live on today at the Labs. In addition to research, she played a key role mentoring some of today's scientists at Sandia.

**Photo from the Sandia archives**

Renlund began her career at Sandia in 1981, just a few years after earning her doctorate in physical chemistry from the University of Utah at age 23. She retired in 2008.

## Enduring programs

A couple of the programs that Renlund was instrumental in standing up are still operating. One program, where Alex works, is vapor deposition of explosives. Explosives can be evaporated and condensed into a film using a vacuum chamber, giving scientists control of the shape of the film. With control over geometry, scientists can study how the explosive detonates and how the velocity of detonation changes as the film thickness changes.

Renlund's successor, Mike Kaneshige, works in the other program, which studies the response of explosives in abnormal environments, such as fire. Mike remembers that when he started working at Sandia as a postdoctorate employee, Renlund had a project for him.

"That first project that I worked on was an outgrowth of what she had been doing in thermal response of explosives," Mike said. Renlund had an impact on the research culture within explosives, participating in national and international conferences and getting work published in journals. "She did a great job of representing Sandia to the outside world. She was on the National Academy of Sciences and she helped organize the International Detonation Symposium," Mike said. Membership in the National Academy of Sciences is considered one of the highest honors a scientist can receive.

*Making History, Shaping the Future*

## A trusted colleague

Data was important to Renlund. "In her first few hours of work, before a lot of others got here, she would focus on data analysis," Alex said. "She just really, really loved the science. It was her passion."

Renlund was named as a distinguished member of Sandia's technical staff in the mid-90s "for sustained excellence in leading experimental efforts in support of understanding fundamental processes controlling ignition, initiation and performance of energetic materials."

Jill Miller, who retired from Sandia in 2014, worked directly with Renlund for more than 20 years as her technician. "She made science fun," Miller said, adding that people around the Labs trusted Renlund's guidance. "People wanted to be on Anita's team, and they wanted Anita to work on their projects. She was at heart an experimentalist."

## Beyond the science

Renlund took an interest in her colleagues and their careers. She hired Alex and Mike, and they say her workstyle and mentorship helped shape their careers at Sandia. "She mentored us. She gave us a safe place.

She allowed us to learn and develop our own reputations, which is not something that happens normally," Mike said. "Her mentorship of a cadre of people led to them becoming mentors of other folks."

Renlund had a way of making her colleagues feel like family. "She would run some experiments that would take a long time and we would sit in the lab and monitor these experiments and talk. It was a really good way to learn from somebody with more experience about the science and about the organization," Mike said.

Renlund also had a great sense of humor, which made working in the lab fun. "I can hear her laugh now, just thinking about it," Alex said. "There was a lot of good camaraderie and joking in the laboratory while we were conducting serious experiments. It was smart with quick banter back and forth."

As Renlund moved up in the ranks at Sandia to a senior scientist, Miller said Renlund never lost sight of her colleagues. "Anita cared about people, and she thought it was important to help them develop their careers."

Alex knows that firsthand. "She allowed me to proceed with this idea about depositing explosives in order to perform detonation experiments," he said. Alex was hired as a limited-term employee. As they developed the early ideas about depositing explosives, Renlund converted Alex to a regular employee. "I call her every year on her birthday. The reason I do that is because she had such an impact on my career."

## Women's History Month events

Sandia Women's Action Network is hosting events throughout March to celebrate Women's History Month. Check Sandia Daily News for more information about this events and links to attend virtually.

**March 11**
I was an intern — The chronicles to success
Noon-1 p.m. MT, 11 a.m.-noon PT

**March 19**
2024 SWAN Leadership Panel
11:30 a.m.-1 p.m. MT, 10:30 a.m.-noon PT

**March 21**
DOE Interlaboratory Women's Collective: The women in the area, with Kate Maxwell
Noon-1 p.m. MT, 11 a.m.-noon PT

# Sandia Fellow Tina Nenoff elected to National Academy of Engineering

*Recognition for innovative contributions in engineering theory and practice*

*By* **Neal Singer**

Sandia Fellow Tina Nenoff has been elected a member of the National Academy of Engineering, one of the highest distinctions for a researcher.

Membership in the academy celebrates those who have made significant contributions to engineering theory and practice, as well as those who have demonstrated remarkable achievements in pioneering new and evolving fields of technology.

Tina's recognition stems from her pivotal role in translating fundamental understanding of nanoporous materials into applications with societal and national security impacts.

Her impressive research record includes more than 190 peer-reviewed articles and four book chapters published, along with 17 U.S. patents awarded. She also has delivered more than 100 presentations at national and international conferences covering a broad spectrum of materials science topics.

Her collaboration with a Sandia colleague on the spongelike properties of crystalline silico-titanates led to the cleansing of an estimated 40 million gallons of radioactive water at Japan's Fukushima Daiichi nuclear power plant, following the damaging effects to its reactors and buildings by an earthquake-induced tsunami in 2011.

Recognizing the value of Tina's technical counsel, she was appointed as deputy and science adviser to NNSA Administrator and DOE Under Secretary for Nuclear Security Jill Hruby, a former Sandia director and herself an academy member. This two-year appointment began in March 2023.

In a congratulatory note that implicitly acknowledged the extent of Tina's contributions, Labs Director James Peery wrote: "Tina: Well-deserved and an honor to work for you!"

**EXCEPTIONAL ENGINEER** — Sandia Fellow Tina Nenoff, newly elected member of the National Academy of Engineering.
**Photo by Lonnie Anderson**

Tina attributes her success to early parental support, an excellent high school teacher and undergraduate research at the University of Pennsylvania with Alan MacDiarmid, who received the Nobel Prize in chemistry in 2000. Reflecting on her time with MacDiarmid, she recalled,

"He had not yet been awarded the Nobel and would not be for a few years, but everyone could feel the energy and excitement of the work that was ongoing in his labs. That was enthralling to me."

Tina was among 114 engineers and 21 foreign associates whose election was announced Feb. 7, bringing the academy's total U.S. membership to 2,310 and the number of international associates to 332. The formal induction ceremony is scheduled for Sept. 29.

Established in 1964 under the charter of the National Academy of Sciences, the National Academy of Engineering serves as a parallel organization of exceptional engineers. It shares with the National Academy of Sciences the responsibility for advising the federal government, sponsors engineering programs aimed at meeting national needs, encourages education and research, and acknowledges the superior achievements of engineers.

Present, retired and former Sandians listed as members of the National Academy of Engineering include C. Paul Robinson, James Asay, Jackie Chen, Tom Cook, George Dacey, Paul Fleury, John Galt, Gary Grest, Walter Herrmann, William Jack Howard, Jill Hruby, Charles Jakowatz Jr., Miriam John, Tamara Kolda, Laura McGill, Tina Nenoff, Gordon Osbourn, Julia Phillips, Dana Powers, Eugene Reed and Albert Westwood.

# Discover STEAM Day a success

**THE ART OF SCIENCE** — Kara Komula, member of the Sandia's Women's Action Network, inspires kids to try their hand at engineering at Discover STEAM Day, hosted by the National Museum of Nuclear History & Science. More than 600 visitors enjoyed a day of participating in science, technology, engineering, arts and mathematics activities at the annual event.
**Photo courtesy of the National Museum of Nuclear Science & History**

# Mileposts

Mike Arviso 35

Nancy Aldridge 30

David Bliss 30

Brian Griego 30

Nicole Morgan 30

Michael Chandross 25

David Karelitz 20

Matt Hoffman 15

Cary Pratt 15

## Recent Retirees

Doug Weiss 38

# Retiree Deaths

*Sept. 13, 2023 - Feb. 13, 2024*

| | |
|---|---|
| **Vernon Shiplet (age 82)** | Sept. 13, 2023 |
| **Daniel Murphy (92)** | September 13 |
| **Clarence Robertson (92)** | September 16 |
| **Janda Panitz (79)** | September 18 |
| **Gladys Kimberling (96)** | September 20 |
| **Donnie Papineau (90)** | September 25 |
| **Janet Clarke (79)** | September 28 |
| **J. Daniel Tebbs (85)** | September 28 |
| **Gerald Record (82)** | October 2 |
| **David Bullington (68)** | October 4 |
| **Roger Goode (80)** | October 6 |
| **Harold Garcia (86)** | October 11 |
| **Stanley Love (88)** | October 11 |
| **Frank Whiston (82)** | October 12 |
| **Harold Hunt (95)** | October 14 |
| **Jeffrey Manchester (79)** | October 15 |
| **Brian Behling (72)** | October 26 |
| **Charles Fuller (77)** | October 27 |
| **Daniel Garber (80)** | October 27 |
| **Richard Lujan (97)** | October 29 |
| **E. Zaffery (89)** | October 30 |
| **Thomas Sanders (77)** | November 1 |
| **Wayne Chrisman (84)** | November 3 |
| **Judith Fahlberg (85)** | November 5 |
| **Christopher Strome (72)** | November 8 |
| **Richard Berg (94)** | November 13 |
| **Shirley Anderson (86)** | November 14 |
| **Carolyn King (83)** | November 17 |
| **Lawrence Larsen (80)** | November 17 |
| **Robert Crow (94)** | November 19 |
| **Julian Sanchez (95)** | November 21 |
| **William Sullivan (89)** | November 22 |
| **Dennis Huffman (89)** | November 25 |
| **Janet Inzerilla (89)** | November 25 |
| **Raymond Hibray (82)** | November 27 |
| **John Holmes (87)** | November 28 |
| **John Webb (84)** | December 3 |
| **K. Sutton (95)** | December 6 |
| **Kenneth Kvam (81)** | December 7 |
| **Pete Oliver (85)** | December 8 |
| **Harvey Morse (93)** | December 11 |
| **Glenn Dietel (92)** | December 13 |
| **Robert Anderson (86)** | December 17 |
| **Charles Stillwell (93)** | December 19 |
| **Jeremy Sprung (85)** | December 20 |
| **Alfred Bauer (90)** | December 24 |
| **Ronald Martinell (90)** | December 25 |
| **Peter Stirbis (88)** | December 25 |
| **Manson Smith (83)** | December 29 |
| **E. Alexanderson (92)** | December 31 |
| **Harry Weaver (85)** | January 1, 2024 |
| **Linda Gibson (70)** | January 5 |
| **John Walter (93)** | January 5 |
| **Thomas Williams (93)** | January 6 |
| **Merle Riley (82)** | January 7 |
| **Richard Isler (86)** | January 7 |
| **Richard Bryant (91)** | January 8 |
| **Harold Folley (89)** | January 11 |
| **Roy Johnston (80)** | January 11 |
| **Hubert Filusch (90)** | January 15 |
| **Susan Leach (70)** | January 21 |
| **Gerald Weber (86)** | January 23 |
| **Wynona Sexson (80)** | January 25 |
| **T. Bryant (89)** | January 30 |
| **Michael Birnbaum (81)** | February 7 |
| **A. Ouellette (89)** | February 9 |
| **Norman Demeza (80)** | February 13 |