

# SpotLight

THE PEOPLE  
WHO DRIVE  
OUR SCIENCE  
& TECHNOLOGY

November 2023

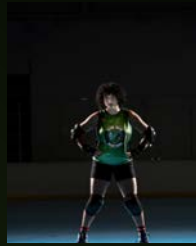
LAWRENCE LIVERMORE NATIONAL LABORATORY



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- Knocking on wood
- Hidden gems
- A walk on the wild side
- Mr. Roboto

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Roller derby competitor **Anashe Bandari** has long loved roller skating since she was a child, but now she's moved on to roller derby.



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We hope you enjoy this edition of *SpotLight*. We'd also like to hear from you. Send us your thoughts and suggestions, whether it's what you like — or even what you don't — about this magazine, or if there is something you would like to see in coming editions. You can reach us via email at [osc@llnl.gov](mailto:osc@llnl.gov).

# DON'T STOP ME NOW

By Michael Padilla

**Anashe Bandari discovered roller derby as an outlet to meet friends, seek an adrenaline rush and strengthen communication skills**



Anashe Bandari, aka Marie Fury, is part of Silicon Valley Roller Derby, a team that meets in San José. Photo: Blaise Douros/LLNL.



Bandari first started skating when she was 6. On left is Bandari and her coach Tammy Patino. Photos: courtesy of Anashe Bandari.

**B**umps, bruises, blocks and an occasional tumble don't stop Anashe Bandari from competing in roller derby, a full-contact sport played at breakneck speeds on eight wheels.

What started as an outlet to meet new friends while getting away from her physics studies has now turned into a weekly competition for Bandari, a writer for Lawrence Livermore National Laboratory's Technical Information Department. Her roller derby passion started five years ago while attending graduate school at William & Mary in Williamsburg, Virginia.

"I felt as if I was lacking in a strong camaraderie of women," Bandari said. "I was having a hard time and really struggling, so I decided to see what roller derby was all about."

She headed to a local rink in Virginia and joined a team, though that was not her first time on skates. As a kid, Bandari did a type of skating called precision skating, which is essentially synchronized figure roller skating. She was based out of Moonlight Rollerway in Glendale, California and she competed mostly at regional competitions around California.

"I started skating when I was 6 years old and continued until I was 12, when I broke my ankle — not skating, ironically," she said.

After recovering from that injury, she continued skating in a less-formal capacity. She took lessons on and off, but mainly just for fun. Her first job was at the roller rink when she was 17.

"That job really enabled me to spend a lot more time on wheels and helped reignite the flame," she said. "Working at the rink gave me free access to any of the public sessions and discounts on private lessons, and I met a lot of people that did different types of skating. I kept going back to work there every summer I was home from college."

Currently, Bandari is part of Silicon Valley Roller Derby, a team that meets in San José, where she serves as a blocker. Bandari is known as Marie Fury, a play on Marie Curie and her number is 96, the atomic number for curium. Even though the Curies didn't discover that element, it's named after them and fits in with the theme.

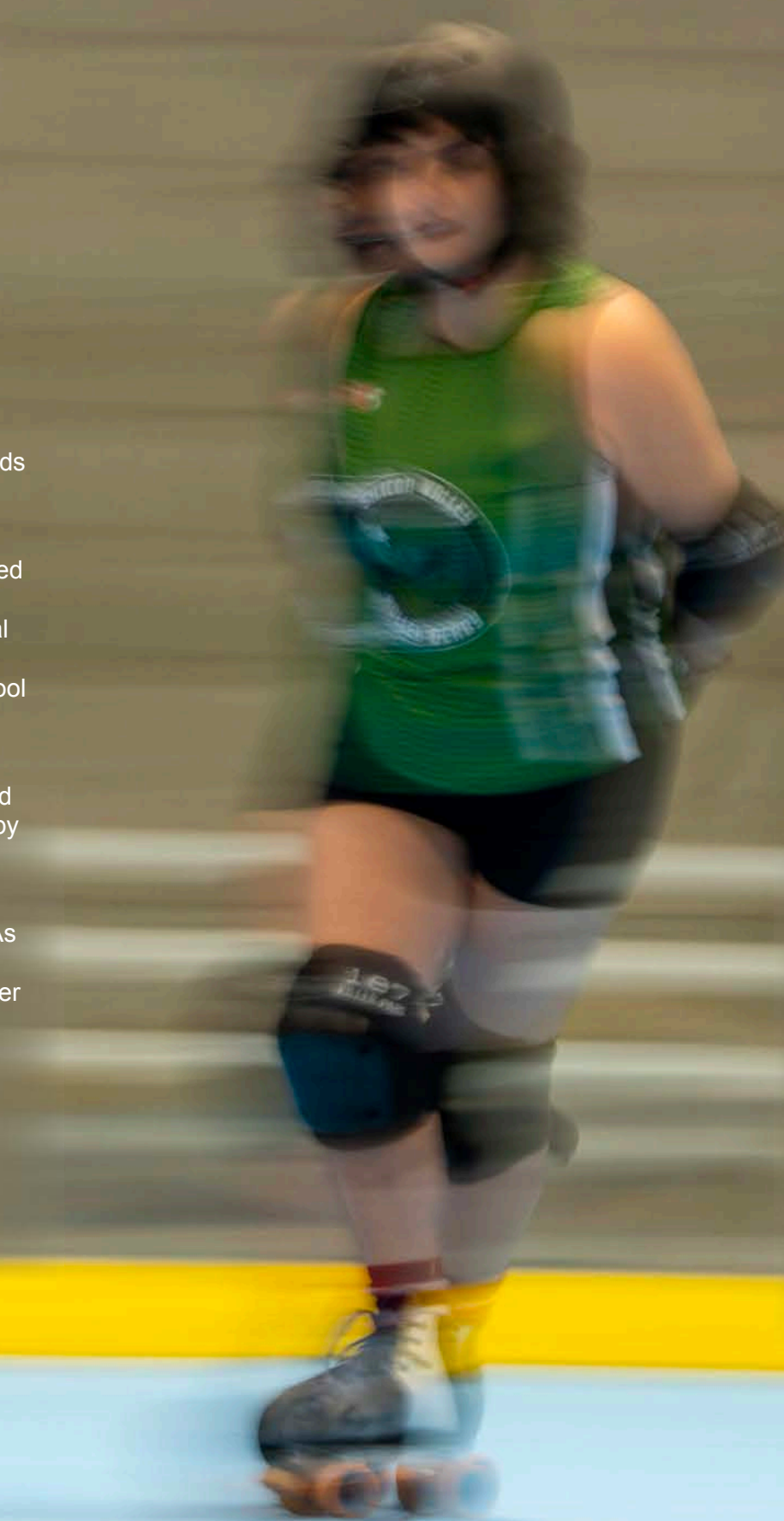
"My teammates call me Fury for short, which I think is kind of funny because I don't think I'm very furious," she said.

As Bandari explained it, a roller-derby match takes place on an oval-shaped track with two teams, each with five people on the track at once. At the end of each two-minute round, the five skaters rotate out for a break and a new set of five from the team rotate in. Four of the team members are dubbed blockers and the fifth is called a jammer.

"The way the game works is the jammer scores points by lapping the opposing team's blockers," she said. "As a blocker, your goal is to stop the other jammer and when possible, to help your jammer through. Usually there are three people skating forward and one person that is skating backwards. This is not the rule, but it is the efficient way that usually works out."

## For the thrill of it

Bandari described roller derby as an adrenaline rush that takes over and helps her forget how scary it can be skating going up to 15 miles per hour on wheels. She especially likes going fast when her favorite skating song, "Don't Stop Me Now" by Queen, is playing, which she said has come a long way from her first routine when she was six at a Christmas show set to "Frosty the Snowman."



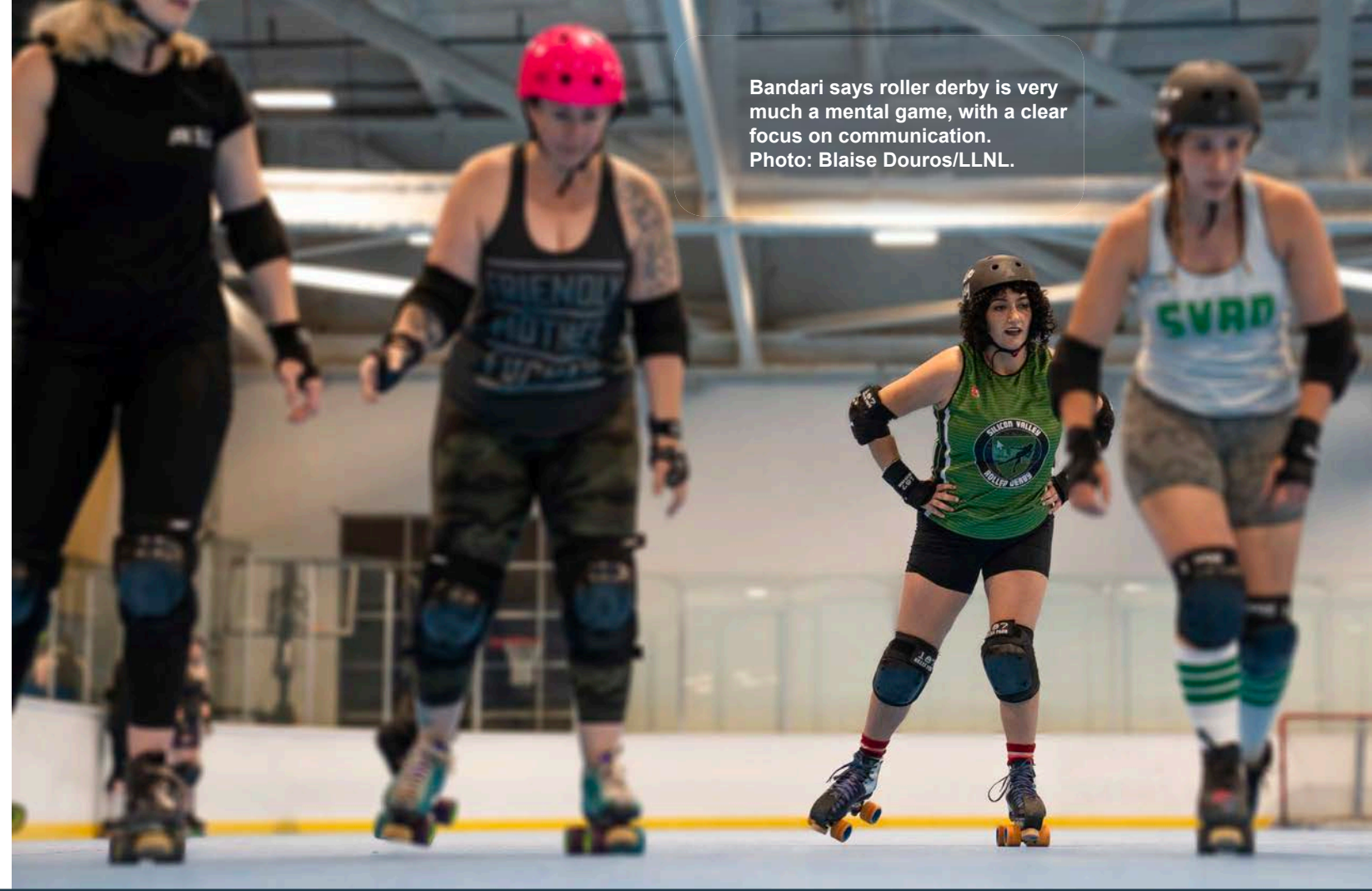


Bandari describes roller derby as an adrenaline rush that helps her forget how scary it can be skating while going up to 15 miles per hour on wheels. Photo: Blaise Douros/LLNL.

“When I think about roller derby while I’m not playing, it sounds terrifying, she said. “It sounds pretty crazy to willingly put myself in this really vulnerable position playing an aggressive, dangerous, full-contact game. I just love skating and I’m happy to be there with my teammates working together and feeling strong and capable.”

She said roller derby is very much a mental game, with a clear focus on communication.

“It’s one of those things where when you’re thrown in the moment, you kind of just stop thinking and your muscle memory takes over and you’re a lot better at it than you thought you were,” she said. “No matter how many times you’ve done it, it is always going to be terrifying to be standing on wheels and waiting for someone to hit you.”



Bandari says roller derby is very much a mental game, with a clear focus on communication. Photo: Blaise Douros/LLNL.



Bandari serves as a blocker for her team. Photo: Blaise Douros/LLNL.

She said roller derby, which started in the 1930s, is a lot safer now than it was in the 1970s. She said it is a lot more formal now, which includes having a governing body with an emphasis placed on safety, even though obviously it’s still dangerous.

**Communication is key**

Bandari said communication with other team members is important when working together to block the jammer, who is skating around fairly quickly.

“You have to be ready for her coming back through in maybe 10 seconds,” she said. “You really have to perform and try to figure out which direction she will go and you’re ready to hold her there. A lot of communication goes into it. And that’s something that I feel everyone can work to improve.”



communication aspect is really big, especially for the person who is skating backwards. Bandari is usually the person who is seeing the skater come in and has to vocalize commands such as “Hey, guys, we’re gonna move left, we’re gonna move forward.”

Communication is something that carries over to her job as a science writer as well.

“Being a team player to me is being sure to contribute your own skills in favor of what the larger team needs to accomplish,” she said.

Bandari said that, overall roller derby is less intimidating than it seems and encourages those who are interested in taking part in the sport to do so.

“It’s a really, really welcoming community, I always think of it as a home for misfits and people that are looking for camaraderie. If you’re interested in doing it, there’ll be a place for you,” she said. “Roller derby is a healthy outlet and I can be calm in the rest of my day-to-day life. I just love it and it makes me feel strong and powerful and proud of what my body can accomplish.”

Bandari loves skating and enjoys being with her teammates. Photo: Blaise Douros/LLNL.

# As the wood turns: LLNL's Fisher finds creative outlet in woodworking

By Jeremy Thomas

As a child growing up in Livermore, John Fisher would accompany his father Dennis to the garage, where the woodworking tools were kept. Amid the sawdust, drills and tins of wood varnish, the younger Fisher absorbed knowledge of the craft while helping his dad glue together cabinets and other projects. The experience sparked an interest in woodworking that would remain steady over the years. When Fisher moved into his own condo, he set up a small shop where he refinished furniture.

In 1999, Fisher moved his family to a house with a three-car garage in Tracy, giving him more room to expand his burgeoning hobby. Poring through woodworking magazines, he fashioned speaker cabinets, made his daughters, Anna and Sadie, their own beds and writing desks and built other furniture for their home. With the help of YouTube videos, he taught himself the art of woodturning, using a lathe to shape salt and pepper grinders, wine stoppers and larger salad bowls, using green wood from fallen trees.

"I like woodworking because it's different from my day job," Fisher said. "At work, I write computer code, do IT (Information Technology) system



Lawrence Livermore National Laboratory Information Technology Operations Division Leader John Fisher has turned his lifelong passion for woodworking into a side business, selling wine stoppers and bowls he fashions in his 2,400 square-foot home woodshop. Photo: Blaise Douros/LLNL.

administration and lead workforce management — none of that is physical or tactile. I like the contrast of working with something where you make cuts and shape something into a physical object. That's very enjoyable, making something out of nothing."

Fisher started off making his custom homemade wine stoppers as "a lark," something to practice while learning how to use the lathe. He posted his first one on Facebook and immediately drew attention from family members.

"My cousin responded and said, 'Will you sell me some of those?'" Fisher explained. "Then I thought, 'maybe I'm onto a good thing.'"

In 2018, Fisher started his own Etsy site. The wine stoppers sold well and Fisher added salad bowls, which became quite popular. With help from his wife Cathy, he began plying his wares at craft shows, the Tracy farmers market, at churches and local festivals. He expanded into dog-food bowls, purchasing a soldering iron with a dog pawprint and burning the prints into the wood after shaping the bowls.



Over the years, Fisher has created numerous pieces of furniture for his home. He is proud of the media center he recently built, which he customized with his own unique style. Photo: courtesy of John Fisher.



One of Fisher's hottest items on his Etsy store are his custom wine stoppers, the biggest seller being a purple and silver edition. Photo: courtesy of John Fisher.

"The dog bowl was just sort of an invention of mine," he said. "I don't know how I got inspired to do it. It was just something I tried out and it actually ended up selling pretty well."

To date, Fisher figured he's made about 200 wine stoppers, his biggest seller a purple and silver edition.

"It's relaxing and therapeutic to make a new one," Fisher said. "I can go out there and while I do have to do some thinking about it, I've got my headphones on — usually Bruce Springsteen music — and I can just build something. It's not overly stressful. Making large furniture pieces is fun as well, but it can be a stressful process when you make mistakes."

In his day job as the Lab's Information Technology Operations division leader and a DevOps team lead for the National Ignition Facility, Fisher enjoys the challenge of streamlining workflows and finding efficiencies. It's a skill he carries over to his craft.

"To me, a lot of fun is refining a process," Fisher said. "Even in my work life, I'm always interested in workflows and ways we can work and collaborate better. I've gotten the wine-stopper shaping and finishing down to 30 minutes. I have a specific shape I do that's very repeatable. I use specific colors and different wood patterns for variety. That process refinement was fun and it's been fun selling them."

Fisher said while his father will spend three months working on one artistic bowl, Fisher's bowls are more utilitarian; he can produce several a month. And he's teaching what he's learned to the broader woodworking community. He started his own YouTube channel where he's posted videos demonstrating the basics of how to turn a newly fallen tree into a bowl. Each project starts with freshly cut pieces, which he usually sources from an arborist friend. His favorite wood to work with is walnut for its interesting patterns and colorations. Maple and purpleheart are close seconds.

"It's a discovery process with each piece of wood," Fisher said. "You start off with a fallen tree and then you get to that point where you've got this colorful, uniquely shaped salad bowl. Finding the nature's design in that is really fun."

Woodturning, he said, is a "bit of a guessing game. It can be difficult to tell whether the finished product will be good or not from the log or even the first cuts into it.

"You need to rough turn the bowl to really get a feeling for what the grain pattern or the colors are



With the help of YouTube videos, Fisher taught himself the art of woodturning, using a lathe to shape salt and pepper grinders, wine stoppers and larger salad bowls using green wood from fallen trees. Photo: Blaise Douros/LLNL.

going to be,” Fisher said. “The reason some bowls end up not making it through the full lifespan is that you do a rough turn and then you leave them for six months and they crack or warp so badly that they’re not usable, so I have to throw some away.”

### **Zen and the art of woodworking**

In late 2019, three months before the start of the COVID-19 pandemic, Fisher moved his family into a larger home in Tracy. He overhauled an auto shop out in the backyard that the previous owner had built, turning it into a 2,400 square-foot woodshop complete with two table saws, a bandsaw, lathe, router, planer, joiner and three sanders, as well as wood storage and a dust-collection system with hookups to the shop’s myriad of power tools.

“It’s big enough that I’ve got room to keep multiple projects going concurrently. It’s nice to have these big tables available to keep my efforts separate and organized,” Fisher said.

More complex projects have typically started with a plan pulled from a woodworking magazine, except for his recently built media center in an upstairs movie theater, which he customized in his own unique style. His favorite projects were building beds and dressers for his daughters. For one of the dressers, he heavily modified the magazine plans so it matched the styling of the bed.

“That wasn’t the plan that I started with,” Fisher said. “It was nice to be able to have a project that started with a baseline, where somebody’s already measured

out the specs for you, but then I was able to do a lot of innovations and add some creativity within that as well.”

On the other hand, building furniture is “a lot more engineering and less creative” than woodturning, Fisher said. Furniture projects generally start with large sheets of wood; and since a sheet of plywood can cost more than \$120, there’s more emphasis on which cuts need to be done to use the wood efficiently, so none of it goes to waste.

“They’re not kidding when they say, ‘measure twice, cut once,’” Fisher said. “There’s a lot of engineering and planning ahead required. You need to closely read directions because if you do things in the wrong order, you can really put yourself in a bind.”

Each project has been a learning experience. One particularly challenging project, a rolling tool cart with drawers, was “a bit beyond my capabilities at the time,” Fisher admitted. He got halfway through and set it aside for more than a year, before going back with greater expertise and some new approaches. He was eventually able to finish it and still has it in his shop today.

“Hard maple is challenging to work with and I didn’t have the tools to really do it properly,” Fisher recalled. “When I cut the wood, it would burn my table saw blade and cause my power breaker to pop. When I’d put in a large bolt, I’d break the bolt off, despite a sizable pilot hole. I had to learn some new techniques to end up with the results that I wanted.”



Fisher enjoys working on collaborative projects with his daughters, like this birdhouse he built with his daughter Anna when she was young. Photo: courtesy of John Fisher.



When his daughter Sadie was a young girl, Fisher crafted a bed for her — with Sadie’s help. Photo: courtesy of John Fisher.



After shaping the bowls, Fisher uses a soldering iron to burn paw prints into the wood, turning them into dog-food bowls. Fisher’s dog Scout approves. Photo: courtesy of John Fisher.

Fisher wanted to give up on the project several times and throw it away, but persevered and was proud of the final product. Besides persistence, Fisher said novice woodworkers should learn to cultivate patience and know when to stay out of the shop.

“If you’ve had a bad day and you’re carrying that inside of you, you might find yourself starting to make mistakes or rush things,” Fisher said. “I would get myself in trouble [in the past] and screw up something big. Some of the projects are complicated and there are times where you just need to step back and say, ‘probably not a good day to be in the shop right now.’ You don’t want to waste the wood and ruin the project.”

Fisher (knock on wood) has never suffered a serious injury while using a table saw or other power tool. Safety is a trait he also might have picked up from his father, a former associate director for Safety, Security and Environmental Protection and associate director for Engineering. Dennis Fisher is turning 80 this year, but still enjoys working in the detached wood shop that he built from scratch at his Livermore home. It’s not uncommon for him to offer his son tips and advice on places he might be stuck on in his latest projects.

Fisher said he’s unsure what the next phase of his woodworking hobby will look like, but he’d like to continue to make more salad bowls, which have become hot items. A father-daughter project with Sadie, a desktop clock, is half finished and Fisher hopes they can complete it soon. One day, he would like to tackle his dream project: a grandfather clock.

“It’s a big challenging project that would be neat to add to the house, so I’m always looking for plans for that,” Fisher said. “I don’t think I could do the ones that have all this ornamentation and are really extravagant, but doing something elegant and attractive would be fun.”



Each project starts with freshly cut wood, which Fisher usually sources from an arborist friend. His favorite wood to work with is walnut for its interesting patterns and colorations. Photo: Blaise Douros/LLNL.

# The zen of the gem

By Patti Koning

In his free time, optics expert Tayyab Suratwala immerses himself in faceting gemstones.

Every stone is a new challenge. Within each one is a breathtaking gem waiting to emerge and dazzle — if the right sequence of cuts, angled perfectly, is applied with optical design precision and artistry.

“It is tremendously fulfilling to see and control the transformation of a transparent ordinary rock with random shape to a beautiful gemstone, maximizing its brilliance, dispersion and color,” said Tayyab Suratwala. “This hobby is an interesting combination of materials science, materials processing and optics. It requires a lot of patience. You just can’t do it on a schedule, but that’s what draws me in, the zen of putting everything else aside and just playing with the materials. It’s very therapeutic.”

As a materials scientist and Optics and Materials Science & Technology Program director, Suratwala has always been drawn to rocks, minerals and other interesting materials. About 30 years ago, he began collecting rocks on his travels.

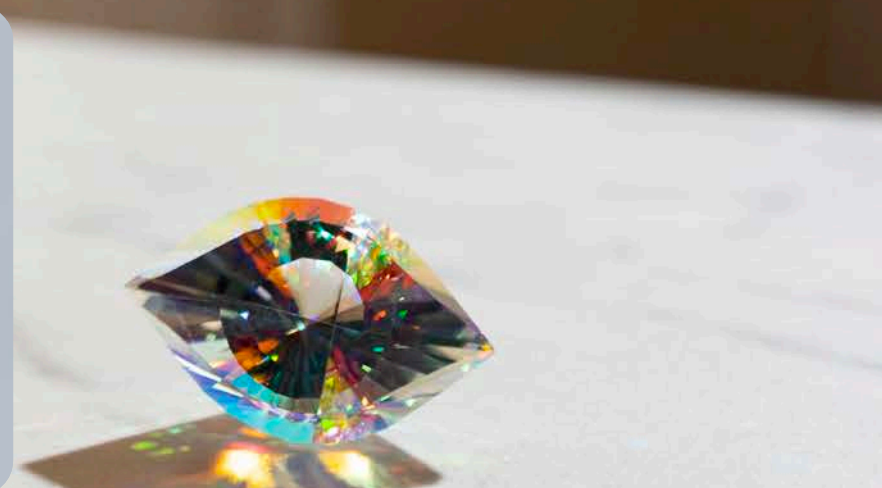
“Pretty soon my living room became a showcase for my rock and mineral collection,” he said.

The centerpiece is a five-foot square glass topped coffee table, filled with a jumble of rocks and minerals. In the early lockdown days of the pandemic, he spent a lot of time looking at this collection wondering what he could do with it.

“At work, I lead research in grinding and polishing optics for use on the National Ignition Facility and other laser systems,” he said. “I decided to try it at home on a small scale.”



Optics expert Tayyab Suratwala finds peace and fulfillment faceting brilliant gemstones. Some of his favorite projects are an Undine’s Tear cut on sky-blue topaz (top), chevron rectangular cut on blue sapphire (bottom) and Cleopatra’s eye cut on dichroic coated glass (on table). Photo: Blaise Douros/LLNL.





Since he started faceting in 2020, Suratwala has cut about 40 gemstones, all for his personal collection except for one he cut into a peridot ring for his wife. Photo: Blaise Douros/LLNL.

He purchased some off-the-shelf equipment from the hardware store and began working on some obsidian rocks. The result, he said, wasn't very interesting, just smoother rocks in simple shapes like cubes.

He dove further into the hobby and discovered the faceting community. Faceting is the craft and art of cutting, through grinding and polishing, a raw semiprecious stone into a gem to give it facets, or flat surfaces, at controlled 3-dimensional angles. Through faceting, gemstones sparkle by trapping the incoming light in the stone via total internal reflection.

And, by a lucky coincidence, during this time he was invited to speak about optics at a meeting of the Columbia Willamette Faceters Guild, which includes master cutters, professionals and hobbyists among its membership.

"As a hobbyist just getting into faceting, it was incredible to meet so many amazing faceters," he said. "Now they are my resource."

Among those faceters were faceting educator and historian Justin Primm, maker of museum-quality replicas of famous gems Scott Sucher, Faceters Guild President Tim Thomas and John Emmett, associate director of LLNL's first laser program in the 1970s.

Suratwala came to LLNL in 1997, straight from finishing his Ph.D. in materials science and technology at the University of Arizona, to work on laser glass for the National Ignition Facility, which was right at the time of its ground-breaking. Laser glass is one of the Seven Wonders of NIF, breakthrough technologies that made NIF possible. He now leads a team that works on many other optics and their technologies.

Today, in addition to collecting rocks and minerals, Suratwala has a growing stockpile of "rough," or, raw semiprecious stones ready to be faceted into a gemstone to reveal their brilliance. To date he's cut more than 40 gemstones for his personal showcase, although he did make a peridot ring for his wife.



Suratwala grinds and polishes a raw semi-precious stone on a faceting machine. Photo: Blaise Douros/LLNL



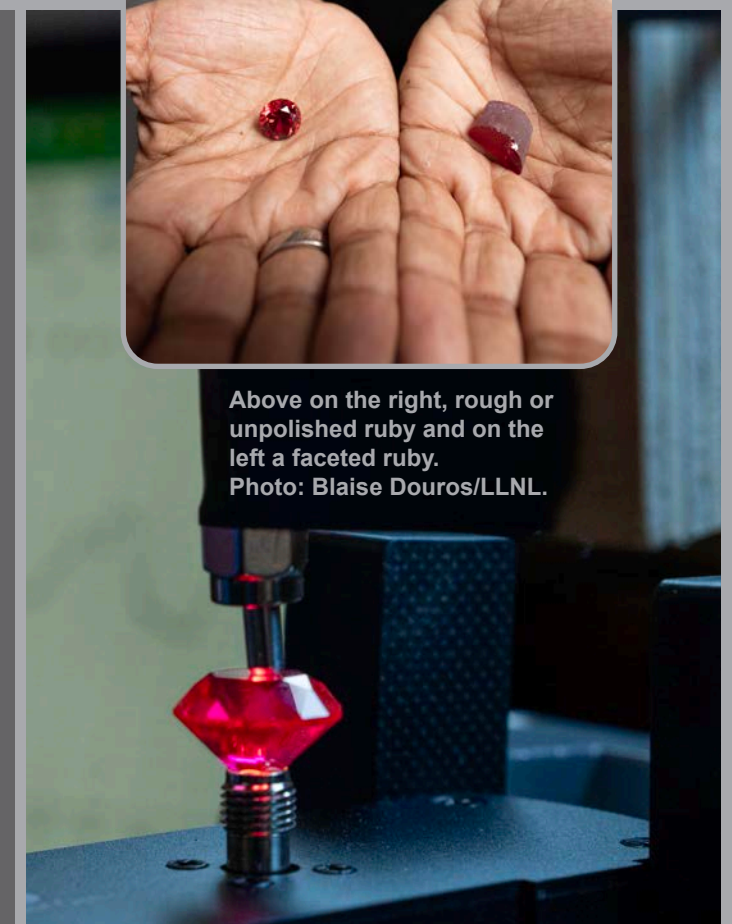
Above on the right, rough or unpolished ruby and on the left a faceted ruby. Photo: Blaise Douros/LLNL.

"There are so many different materials with different properties and they each require a different faceting process. And there are thousands of different designs. Each time I cut, I work to improve my precision and quality," he said. "Faceting is a fascinating combination of artistry and science."

Losing himself in gemstones started as a pandemic hobby, but it's become a source of joy and satisfaction.

"I find myself thinking about the next stone. It's incredibly satisfying to transform rough into a dazzling gemstone," he said. "And it's safe to say that I've acquired enough rough to keep myself busy for the next 15 years. For anyone interested in faceting, I'll warn that it's addictive and can be expensive."

To learn more about faceting, he recommends the Columbia Willamette Faceters Guild website and both volumes of "Amateur Gemstone Faceting" by Tom Herbst.





# Thriving in the wilderness

By Paul Rhien

Discovering confidence, preparedness and serenity through outdoor exploration

Livermore Laboratory Employee Services Association (LLESA) manager Melissa Sale is an outdoor enthusiast who grew up spending time in nature. She reminisces about childhood summers, when playing outside was the norm and kids were expected to come home only when streetlights came on. She recalls the carefree and adventurous spirit of her upbringing, where she spent countless hours exploring the outdoors.

"I remember in the third grade, going and catching tadpoles all by myself in a lake and then bringing them home on my bike," Sale said, noting that the tadpoles eventually turned into frogs, much to her surprise. "To think, in today's day and age, that



Melissa Sale hikes The Wave, the iconic sandstone landmark at Coyote Butte North near the Utah Arizona border. Photos: courtesy of Melissa Sale.

you would let a little child ride their bike somewhere and play in a body of water is outrageous. But that's kind of how I grew up and I didn't really think a whole lot of it at the time."

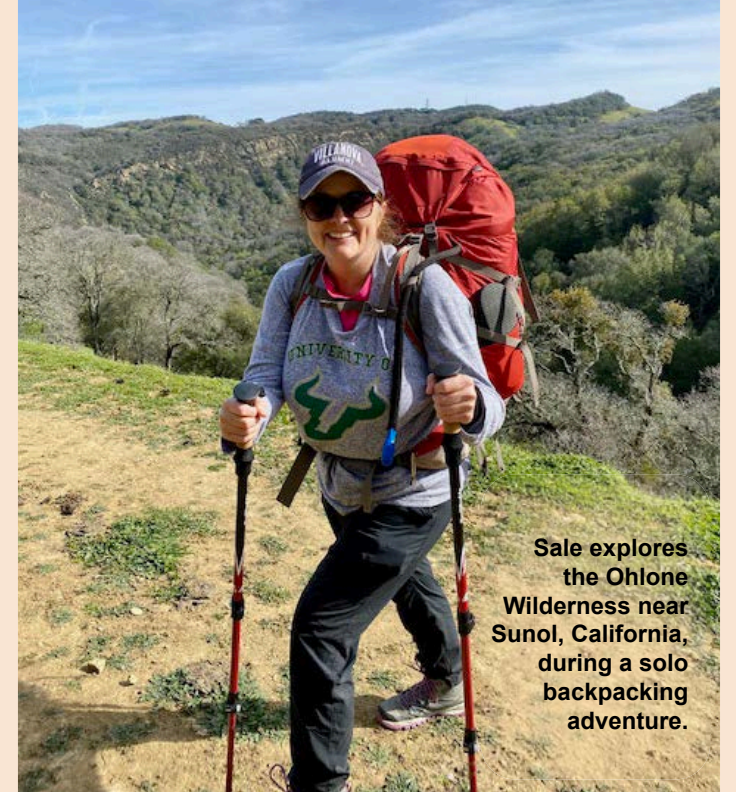
Years later, her passion for hiking developed when her son expressed an interest at 10 years old. Together, they embarked on short hikes, including a memorable outing to Angel Island. However, as her son entered his teenage years, he became less interested in the hobby, leaving their outdoor gear to gather dust in the garage.

## Solo adventure

With her son now grown and moved out of the house, last year Sale pulled her backpack and other outdoor gear out of storage. She and her wife started exploring Del Valle, Brushy Peak, Morgan Territory and other East Bay Regional Parks, gradually building up their experience and exploring different trails.

While planning and training for an overnight backcountry trip on the Ohlone Trail during wildflower season, her wife had a family emergency that she needed to attend to and wouldn't be able to make the trip. Sale's LLESA colleagues encouraged her to take on the challenge of traversing the mountains and canyons of the wilderness preserve alone.

Overcoming initial doubts and concerns, Sale took on the solo adventure and had what she called her



Sale explores the Ohlone Wilderness near Sunol, California, during a solo backpacking adventure.

Cheryl Strayed moment, referencing the famous backpacking journey described in the book "Wild." She recalls a couple of encounters with wildlife, coming across a fox with a squirrel in its mouth on the trail and a coyote yipping outside her tent in the middle of the night.

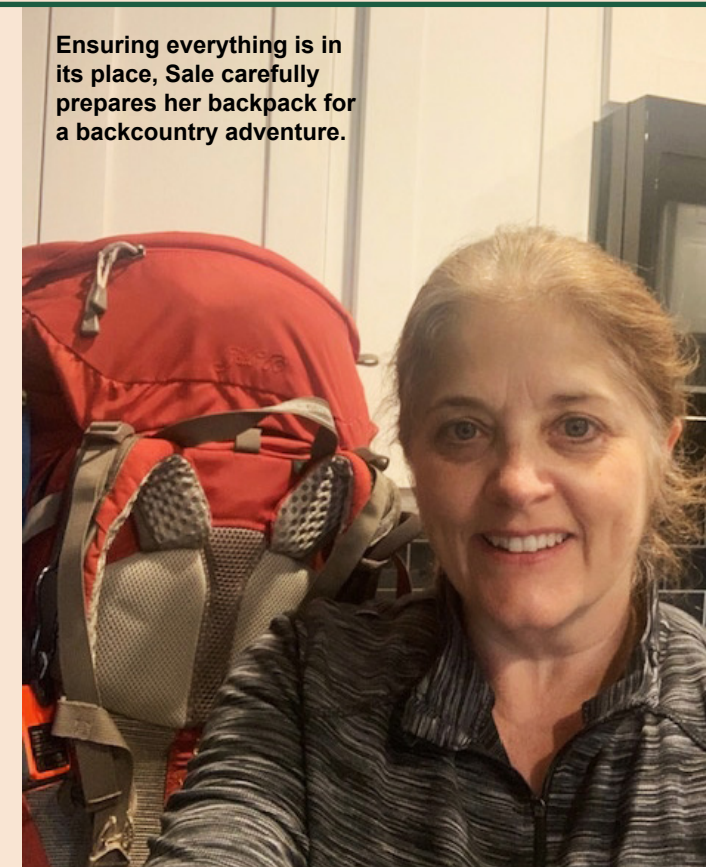
"Despite my initial hesitations, I had a really great trip," Sale said. "My experience backpacking the Ohlone Trail by myself — or as I like to call it the 'aloney' trail — instilled in me a sense of self-reliance, boosted my confidence in handling unforeseen situations and set me up to take on additional experiences."

## Preparation and empowerment

Sale loves planning and organizing her trips, meticulously weighing each item of gear to ensure she carries only what is essential. She finds joy in the preparation process, researching trails and considering factors like weather conditions to make informed decisions. She emphasizes the importance of preparedness and adaptability, understanding that unexpected challenges can arise in the wilderness.

"It's important to me that I think through potential scenarios of things that could happen in the backcountry and identify what gear I am going to take to handle that situation, but not to the point to where I'm packing everything and the kitchen sink," Sale said. "I've learned the hard way that it's way more fun if you're not carrying a really heavy backpack."

Ensuring everything is in its place, Sale carefully prepares her backpack for a backcountry adventure.



Sale enjoys the breathtaking views of the Yellowstone National Park backcountry.



Sale believes that spending time in nature positively impacts her mental and emotional well-being, providing a sense of serenity and an opportunity to disconnect from the fast-paced modern world.

“Being alone in nature, I really appreciate the silence and disconnecting from the bustling crowds often encountered in popular tourist destinations,” she said. “There are lots of cool things you can see on a driving tour of some of our national parks. But I love when you get in the backcountry and come across spectacular views or become immersed in unique landscapes and sights you can only experience by hiking in.”

### ***Inspiring connections and sharing experiences***

Sale’s love for the outdoors has become an integral part of her life, fueling her desire to embark on new adventures and explore lesser-known destinations. She is now planning a trip with an Australian friend to complete the Cape-to-Cape Track in Leeuwin-Naturaliste National Park in Western Australia.

“A lot of my friends think it’s a bit of a crazy hobby and don’t consider it a vacation,” Sale said. “Getting away from the hustle and bustle of everyday life, turning off your cell phone and relying on yourself and what you can carry on your back is incredibly challenging, but also incredibly empowering and rewarding. It’s awesome connecting with nature and being completely immersed in the sights, sounds and smells of the outdoors.”

At work, Sale’s adventurous spirit and recent outdoor experiences have piqued her interest in potentially establishing a backpacking networking group for LLESA members. She envisions a space where colleagues can share experiences and resources.

“I think there’s definitely an opportunity to bring people together, go on some outdoor adventures with new friends, or even just a place to talk about the hobby and share gear tips.”



Sale treks through the snowy landscape at Bryce Canyon National Park.

Sale and her wife recently attended a weekend wilderness survival training offered by the Thomas Coyne Survival School in the Santa Cruz mountains, where they learned to build a shelter, start a fire, signal for help and provide basic wilderness first-aid using just those items they could source from the land.

The training prepared them for getting caught in severe weather during a backcountry trip to Yellowstone National Park in May.

“We got caught in a thunderstorm and were rained and hailed on,” Sale said. “We were really glad that we had the preparedness training we did and that we had packed the appropriate gear.”

### ***Solitude and serenity***

Sale’s backpacking experiences have been transformative, rekindling in her a sense of freedom and curiosity about the natural world. Through her experiences, she has grown more confident in her ability to navigate different terrains, make crucial decisions and appreciate the solitude and beauty of the outdoors.



Together with friends and family, Sale ventured into the wilderness of Yellowstone National Park, embracing the untamed beauty and awe-inspiring wonders of nature.

# We are the robotics

By Ben Kennedy

Paul Armstrong guides high schoolers with robots into the arena



Paul Armstrong (center) with two members of GravitechX, the Livermore High School FIRST Robotics Competition team: his daughter at left and his son at right. Photos: courtesy of Paul Armstrong.



With advisor Paul Armstrong at right, Livermore High School's GravitechX FIRST Robotics team.

Robots vs. lasers sounds like a good time for any kid who loves sci-fi and technology. For Paul Armstrong, an engineer in the NIF & Photon Science Directorate, it's his reality. By day, he heads up an experimental team working on advanced laser applications; in his spare time, he guides ambitious high schoolers on a collision course with a worldwide robotics tournament.

In 2019, Armstrong took his middle-school-age kids to the Lab-sponsored Tri-Valley Innovation Fair, where his daughter sparked an interest in robotics — unbeknownst to him. When she arrived at Livermore High School in the fall, she joined the school's FIRST Robotics Competition (FRC) team and was learning how to design, build and operate a robot with them by the time 2020 began. She didn't talk much about it and her father hadn't connected her new interest with the visit to the Innovation Fair.

At a FIRST Robotics Competition, every team has its own pit area where repairs and modifications to its robot can be made.

Armstrong had loved building early Lego-style robots with his Commodore 64 computer in 1980s Klamath Falls, Oregon. He turned to lasers later, but his first love was robotics. When the call came, he naturally agreed to serve as a parent chaperone for the March FRC competition in Fresno.

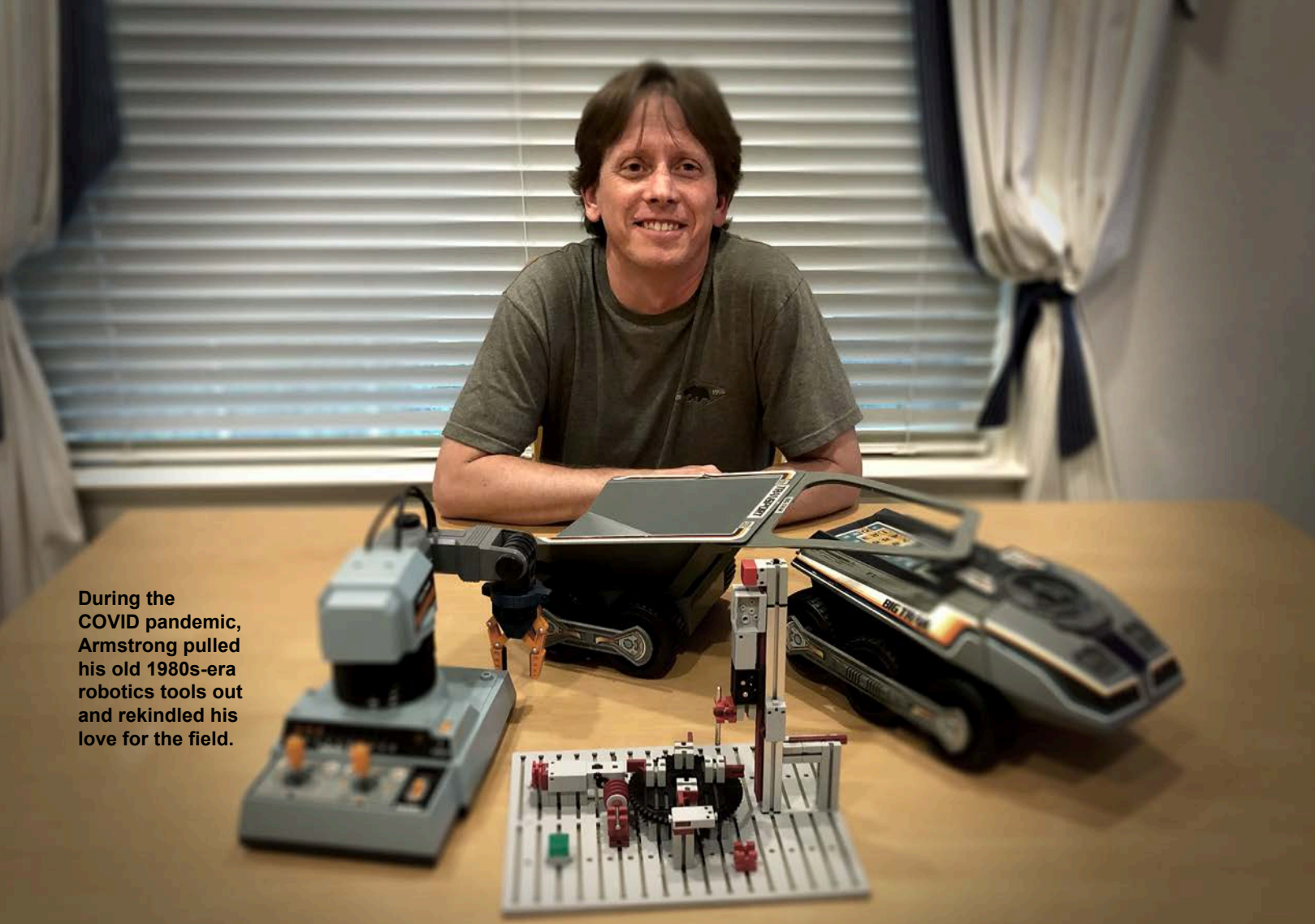
"The competition was the first time I was going to be exposed to FRC and see what they had built as a team," he said. An advance team of about five people loaded the team's robot into a truck and began down the road to Fresno. They arrived expecting to unload the robot and build a custom pit to modify and repair it during competition — but they found a sign on the door that the event had been canceled.

"When you understand how much effort and work went into that robot, that is truly sad," he said. "It was crushing." Armstrong spent the 2020 COVID-19 lockdown updating his old Commodore 64 robots into a modern Arduino platform. Even a year later, as much of the U.S. was reopening, California schools and Livermore High's FRC team, GravitechX, were in no shape to compete.

"Our team and most FRC teams are very student-centric, student-run," Armstrong said. "The students are responsible for everything, which includes teaching new recruits. The upperclassmen teach the freshmen and sophomores their chosen discipline: mechanical, electrical, software or business."

By the time some semblance of normal had returned, the team had lost two classes of experience to graduation and was down to only four people. In stepped Armstrong as a mentor — and his son as a new recruit to reach the required team size of five. Later in the school year, the team had grown to more than 20 students.

"As a mentor, I'll drill a few holes," Armstrong said. "but it's really watching and making suggestions. I'm not saying, 'do it this way, or move, let me do it,' but saying, 'you should consider using an accelerometer to do that, instead of a gyroscope.'"



During the COVID pandemic, Armstrong pulled his old 1980s-era robotics tools out and rekindled his love for the field.

Having a growing group of young people with experience in science and technology isn't a bad return on investment for Lawrence Livermore National Security, which operates the Lab for the U.S. Department of Energy. LLNS is a sponsor of GravitechX, along with several others, through its Community Gift Program.

"I can't figure out a better way to get kids interested in STEM," Armstrong said. "I can't figure out a better way to do it. By the time they come out of this program, the team leads — the mechanical lead, the software lead, the electrical lead — have now led a full engineering team, with deliverables, metrics, the whole nine yards."

It's another way of saying they get the kind of experience that might fit in perfectly at LLNL.



Students at the Livermore High School Robotics team work in a variety of disciplines to make sure the robot works correctly, competes at the necessary level and is financially feasible.

Each January in a worldwide livestream, FRC announces the type of task each team's robot will have to complete at the tournament competitions beginning in March. In 2022, that meant picking up and dropping basketball-sized tennis balls into goals of various heights with a robot that can draw no more than 125 amps of power, be no more than 5 feet tall and weigh as much as 125 pounds. The robots have to run themselves for the first 15 seconds of each match, followed by a two-minute, 15-second semiautonomous phase. For the last 30 seconds, more points can be scored by completing a separate task. The matches are jarringly quick and improving your team's robot can be just as frantic.

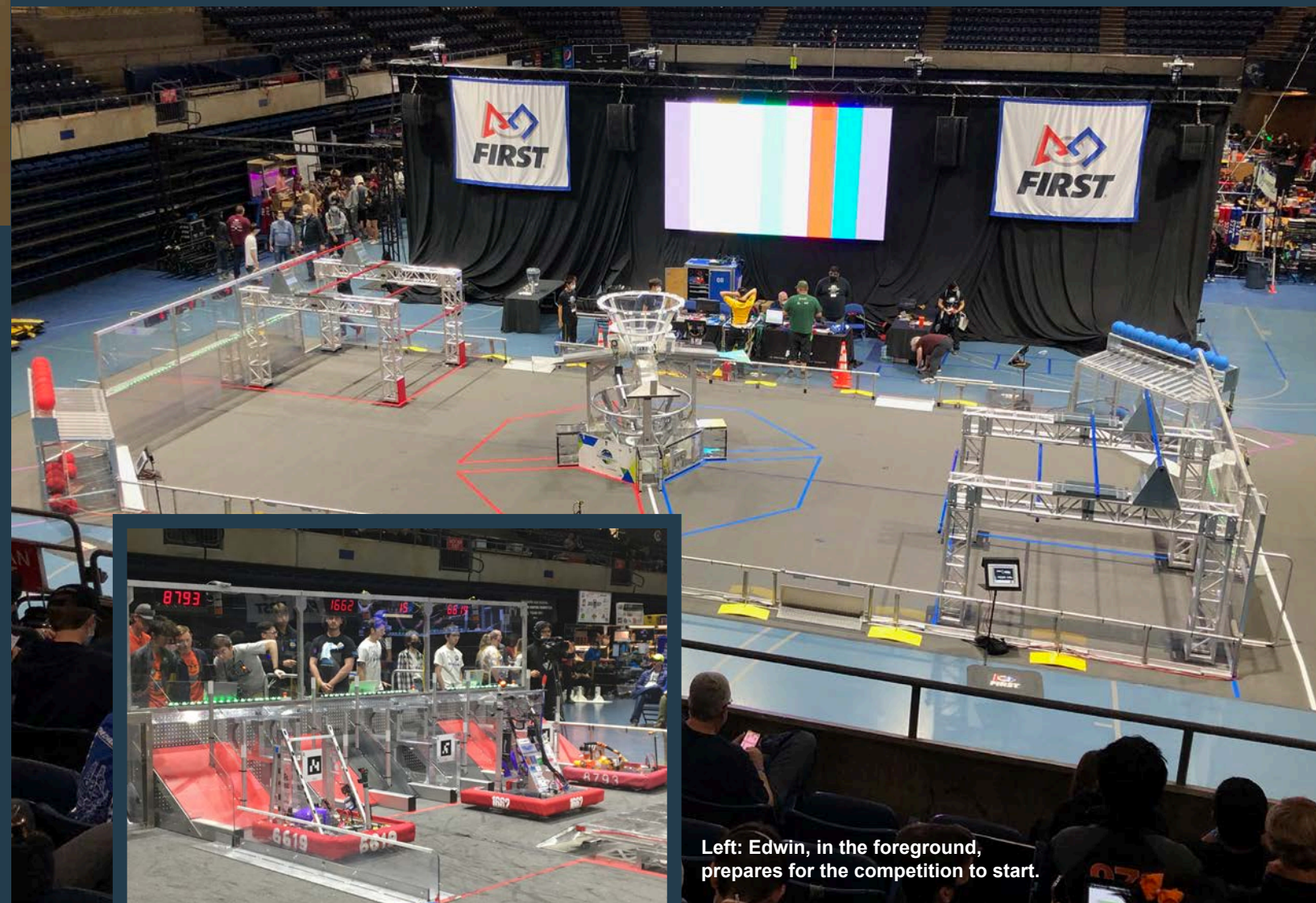
"The pit that first year was a very intense place. I had a fitness tracker on; I burned almost 4,000 calories," Armstrong said, "and took 5,000 steps."

But this is not Pacific Rim or BattleBots; FRC competitions do not ask the robots to try and fight their way through each problem. ("It's not combat

robotics, but it is full-contact robotics," Armstrong said.) The GravitechX team strategized to focus on the low goals and defend against their opponents seeking the high goals; other teams also could cater to a secondary task like building their robot to be able to climb a set of monkey bars toward the end of each match. Winning teams from regional events all over the globe earn invitations to the world championships in Houston.

"I can't say enough about the creativity and the knowledge that these teams exhibit, he said. "It's astounding. It gives you a lot of confidence in the future."

Armstrong's daughter — now the team captain — had led GravitechX from concept to competition in eight weeks with some help from her dad and brother. While the team did not advance out of the 2022 regional, the Armstrong family had saved the team from folding and brought it back to the FRC arena.



Left: Edwin, in the foreground, prepares for the competition to start.

# SpotLight

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