



S A N D I A

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CRADAs
impact =
\$96 billion
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A song of ice and fiber



ALASKAN SUNRISE — A rare, peaceful sunrise at Oliktok Point during the first week of February, when Sandia researchers began collecting the first-ever dataset from the Arctic seafloor using distributed acoustic sensing and a fiber optic cable. To listen to and download a clip of a suspected ice quake captured during the first experiment, [click here](#).

Photo by Kyle Jones

Sandia embarks on first-of-its-kind Arctic seafloor data collection using underwater technique

By **Manette Newbold Fisher**

Sandia researchers are beginning to analyze the first seafloor dataset from under Arctic sea ice using a novel method. They were able to capture ice quakes and transportation activities on the North Slope of Alaska while also monitoring for other climate signals and marine life.

— CONTINUED ON PAGE 4

Here comes the sun

Tethered-balloon tests ensure safety of new solar-power technology

By **Mollie Rappe**

What do tiny dust particles, 22-foot-wide red balloons and “concentrated” sunlight have in common?

Researchers from Sandia recently used 22-foot-wide tethered balloons to collect samples of airborne dust particles to ensure the safety of an emerging solar-power technology. The study determined that the dust created by the new technology is far below hazardous levels, said Cliff Ho, the lead researcher on the project.

Cliff’s team just received funding [to build a pilot falling-particle receiver plant](#) that will incorporate improvements developed from these tests. [See “DOE awards Labs researchers \\$25 million” in this issue, p. 2.](#)

This next-generation renewable energy technology is called a high-temperature, falling-particle receiver for concentrating solar power. [Concentrating solar power](#), while not as common as



SPOTLIT BY SUN POWER — A multidisciplinary team of researchers from Sandia recently used tethered balloons to collect samples of airborne dust particles to ensure the safety of a falling-particle receiver for concentrating solar power.

Photo by Randy Montoya

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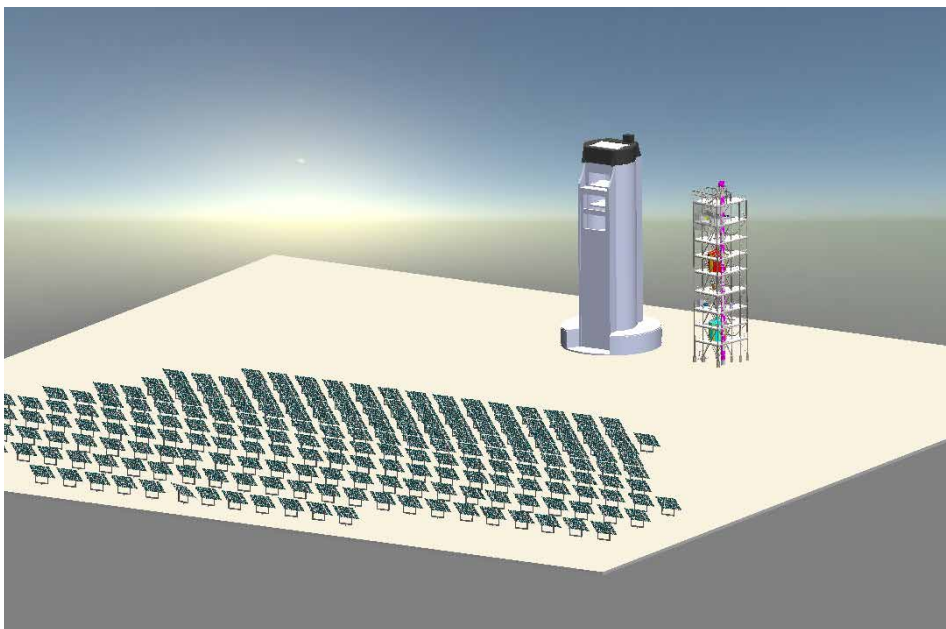
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LAB NEWS ONLINE: sandia.gov/LabNews

DOE awards Labs researchers \$25 million for next-generation solar pilot plant

By **Kelly Sullivan**



THE TWO TOWERS — Proposed G3P3-USA system at the National Solar Thermal Test Facility.

Illustration by Cliff Ho and Kevin Albrecht

DOE has awarded \$25 million to Sandia to build, test and demonstrate a next-generation concentrating solar thermal power plant at the [National Solar Thermal Test Facility](#).

The funding is part of the roughly \$70 million, three-year-old [DOE Generation 3 Concentrating Solar Power systems program](#), focusing on the development of next-generation concentrating solar systems that can achieve higher temperatures to accommodate advanced power cycles that are more efficient, thereby reducing the cost of the entire system.

Cliff Ho, project leader of the Sandia team responsible, said that the competition was unique compared to other DOE grants he's worked on.

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CRADAs, licenses lead to billions in economic impact since 2000

Study shows sales of new products and services supported more than 400,000 jobs

By **Manette Newbold Fisher**

Cooperative Research and Development Agreements and patent license agreements between Sandia and outside partners led to billions in economic impact and supported tens of thousands of high-paying jobs every year for the last two decades, according to a recent study on national economic contributions.

CRADAs and licenses signed with 223 companies between 2000 and 2010 resulted in an estimated \$95.9 billion in total economic impact and \$53.7 billion in total sales of new products and services through 2020, according to the study conducted by federally funded technology transfer center TechLink, in collaboration with the Leeds School of Business at the University of Colorado, Boulder.

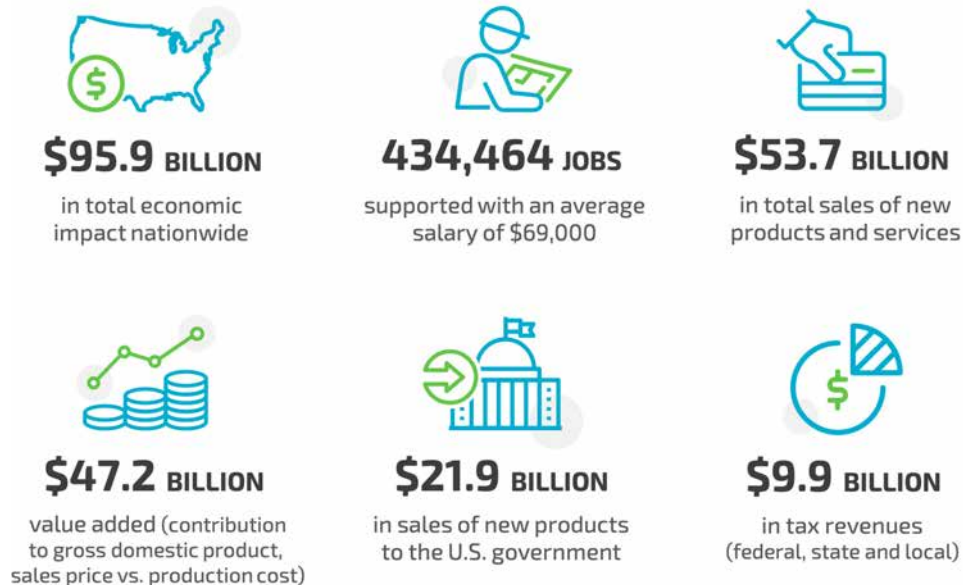
In addition, sales from the beginning of 2000 through 2020 supported an average of more than 20,600 jobs per year — more than 434,000 over two decades — with an average salary of \$69,000.

“Transferring the Labs’ innovative technologies to the marketplace through CRADAs and patent license agreements is a vital part of Sandia’s mission,” said Mary Monson, senior manager of technology partnerships and business development. “We are pleased that the report showed some of the positive impacts of our work with outside partners.”

The study evaluated the extent to which Sandia license agreements and CRADAs result in new products and services, benefit the national economy, improve the nuclear weapons stockpile for the United States and international allies and support NNSA missions.

Other agreements would increase total

According to the study, the results understate the economic impacts because of multiple agreements with confidential outcomes, nonresponsive companies, no adjustment for



BILLIONS AND BILLIONS — Cooperative Research and Development Agreements and patent license agreements between Sandia and outside partners led to billions in economic impact, according to a recent study. **Graphic by Jennifer Plante**

inflation over the 21-year period and other factors discussed in the report.

The research team reached 223 companies with 410 different agreements — 313 CRADAs and 97 patent licenses. Outside partners were asked a series of questions regarding sales of new products and services and other outcomes resulting from the technologies associated with the partnerships, according to the report.

Other highlights of the report include:

- \$47.2 billion in value added, which is the contribution to gross domestic product, or a product’s sales price minus its production cost (excluding labor).
- \$9.9 billion in taxes collected by federal, state and local governments.
- \$21.9 billion in sales to the U.S. government.
- More than \$1 billion in outside investment funding for companies directly due to partnerships with the labs.

The report said more than half of the companies that participated in the study credited CRADAs or license agreements with

providing additional benefits on top of sales. These benefits include scientific and technological value, collaboration, visibility and credibility, and acquisition, among others.

Projects with Sandia resulted in the creation of 33 new companies, according to the study, and 10 companies were acquired primarily because of the technology associated with the tech transfer partnerships with the Labs.

“Programs and agreements such as CRADAs and patent licensing enable the Labs to work with educational institutions, nonprofits, large companies and local businesses. Through work with outside partners, exciting opportunities unfold as we continue to work together to help better the economy and national security,” Mary said. “We continue to expand our portfolio of partners, and in the last few years, we have signed a record number of CRADAs.”


Sandia partnerships extend beyond report participants

In addition to CRADAs and licensing, Sandia works with small New Mexico

companies through the New Mexico Small Businesses Assistance program. Mary said that in 2020 alone, Sandia worked with 133 small businesses in 19 counties throughout the state on technical problems at no cost to the companies. Some of the projects were quickly initiated by businesses working on solutions to COVID-19 problems.

Sandia is also working to help New Mexico companies turn licensed technologies into viable products and services through the state's new Technology Readiness Gross Receipts Tax Credit Initiative. Select businesses that submitted statements of intent last fall are receiving direct technical assistance for prototyping, proofs-of-concept,

field demonstrations, technical validation, and testing and development, among other activities.

The companies all have a CRADA or licenses from the Labs, and the new program helps with a funding gap that many businesses face when trying to develop new technology into products and services. 

A song of ice and fiber

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The team, led by Sandia geophysicist Rob Abbott, connected an iDAS, a distributed acoustic sensing interrogator system manufactured by [Silixa](#), to an existing fiber optic cable owned by [Quintillion](#), an Alaska-based telecommunications company. The cable reaches the seafloor from Oliktok Point. For seven days, 24 hours a day, cable vibrations were captured and recorded, helping researchers better understand what natural and human-caused activity takes place within the data-starved ocean.

This is the first time a distributed acoustic sensing interrogator system had been used to capture data on the seafloor of the Arctic or Antarctic oceans, and the team sees many advantages for future use.

"This is a first-of-its-kind data collect, and as far as what national laboratories do, this is exactly the type of high-risk, high-reward research that could make a huge difference in how we're able to monitor the Arctic Ocean," said Sandia manager Kyle Jones. "This really is on the cutting edge of seismology and geophysics, along with climate change and other disciplines."

Hearing ice breakup and whale songs

The team is expecting to record climate signals like the timing and distribution of sea ice breakup, ocean wave height, sea ice thickness, fault zones and storm severity. Shipping, whale songs and breaching can also be recorded. This new way of monitoring holds the potential to persistently capture a wide variety of Arctic phenomena in a cost-effective and safe manner so that scientists can better understand the effects of climate change on this fragile environment, Rob said.



ARCTIC WILDLIFE — A fox runs on the road that connects Deadhorse, Alaska, to Oliktok Point, where a Sandia team spent a week monitoring the Arctic Ocean. The Arctic is home to a variety of wildlife including migrating whales and seals. The team hopes to capture undersea recordings of the animals using distributed acoustic sensing and a fiber optic cable. **Photo by Kyle Jones**

The interrogator looks like an electronic box that can be attached to the fiber optic cable on land, and it uses a laser to send thousands of short pulses of light along the cable every second. A small proportion of that light is reflected back — or backscattered — along the cable as the seafloor it's attached to moves due to earth, sea ice, ocean current and animal activities. The backscattered light enables the interrogator to detect, monitor and track events along the fiber, and data is stored on hard drives.

"Quintillion's fiber optic cable is in a favorable place on the North Slope of Alaska," Rob

said. "This technology works for this project for several reasons. We are not sending a boat out to plant monitors; we're not traipsing over the sea ice trying to install sensors. This cable will exist for decades and we can take good data on it. It's a very safe way of taking this measurement in a hazardous environment."

Funded by the [Laboratory Directed Research and Development](#) program, this was the first of eight week-long data collections that will happen over the next two years during the project. The team will visit Alaska in each of the four Arctic seasons defined as ice-bound, ice-free,



RESEARCH CHALLENGES — Sandia geophysicist Rob Abbott said one of the challenges of working in the Arctic is the expected but frigid temperatures.

Photo by Kyle Jones

freezing and thawing. A third year will be spent further analyzing data.

Rob said results will be communicated with the broader scientific community and will be provided to the climate modeling community for inclusion in algorithms. Additionally, the team hopes the results of the project will show the need for persistent distributed acoustic sensing monitoring in the Arctic.

“We’d like to provide data to high-fidelity climate models and raw data analysis,” Rob said. “I’m also hoping to conduct a direct measurement of sea ice thickness, which is currently difficult. Right now, you need an airplane flying over or you need to go out on the ice. That can be very dangerous and expensive, and you can only do it once or twice a year. Using a fiber optic cable, the distributed acoustic sensing system could be out there 24/7/365 and you could potentially take a sea ice thickness measurement once per day.”

Encouraging data capture

Sandia researchers are just starting to analyze the first 168 hours of data collected in February, and they are encouraged by what they see, Rob said.

“We see things that are indicative of ice quakes. We see events as far out as 33 kilometers in the ocean where there should be no anthropogenic activity,” he said, referring to the first two hours of data he’d looked at. “We’re certainly seeing a natural event of some sort. It could be an ice quake, or it could be a micro-seismic event in the ground like an earthquake. We’re not sure yet.”

Closer to shore, Rob said the team most likely recorded production and reinjection wells recycling wastewater and frequencies that are indicative of ocean tides and currents. One surprising result was the system picking up frequencies of a low-flying hover craft.

The interrogator can record events at a spatial density of three to four orders-of-magnitude greater than traditional hydrophone or ocean bottom seismometer deployments, Rob said.

“In this first data collect, we weren’t expecting to see a lot of currents and ice quakes because there was stable ice cover over the entire area, and yet we do see some of those things, which is exciting,” Rob said.

Rob said he’s looking forward to capturing data on whales and seals during the

migrating season. The Arctic is home to bowhead and beluga whales, each having individual songs. The system should be able to record these songs in the same manner as recording earthquakes because vibrations in the ocean are transmitted to the earth, which is then transmitted to the cable. With whales, a characteristic pattern develops as the song changes pitch.

“It’s called gliding, where over time, the frequencies start out low and go high and back down,” Rob said. “Frequencies like that are characteristic of biological sources and are easily discriminated from other sources, such as earthquakes. Whales often sing for over 30 minutes with individual repeated notes that last a few seconds long that glide up and down.”

North Slope weather added intensity

The expected but fierce North Slope climate was a challenge. In February, the area is dark about 18 hours of the day and because snow blows much of the time and roads aren’t well marked, everything continues to look new, Rob said. The team was also dealing with bitter cold, and while they were prepared, temperatures were about 10

degrees colder than expected, at one point dropping to minus 45 Fahrenheit (minus 77 including windchill). Even the people who work there for a living shut down all outdoor activities, Rob said.

“The American Arctic is formidable, 30 degrees below zero being a common occurrence in the winter months,” said Michael McHale, Quintillion’s chief revenue officer. “Much of the region is tundra and difficult to traverse in the best of weather. Working here requires significant experience and hard-won expertise. The engineering implications are enormous. Most networks and satellite ground stations do not operate in regions where they need to be able to tolerate 70 degrees below zero.”

Due to harsh conditions, Quintillion’s fiber optic cable is double-armored with copper and steel sheathing to protect against cutting, crushing or abrasion damage, McHale said.

“All of the company’s network components, including the cabling, are engineered to withstand the extreme Arctic environment and protect against network outages,”

he added. “The subsea portions of the cable are primarily buried below the seabed.”

First-time research technique riles nerves


The day after the team arrived, researchers met at the Quintillion cable landing facility where the distributed acoustic sensing system was installed with the help of the company. A team member from Silixa, the company Sandia purchased the distributed acoustic sensing system from, was also there to assist.

Sandia researchers were able to utilize about 30 miles of the subsea fiber optic cabling, McHale said, and setup went smoothly. He added that the project has been a great experience so far.

“The opportunity to work with some of the most knowledgeable geophysicists and data scientists in the country is exciting and an honor,” he said. “Supporting the work of the scientific community has long been a goal of Quintillion’s. Accomplishing that goal with a client as highly regarded as Sandia Labs exceeded our expectations.”

During the first few days of the initial collection, there was anticipated nervousness among the team because this was something that hadn’t been done before. While Rob has used fiber optic cables to record explosions for Sandia, he hadn’t used them on a seabed nor for something this large.

The interrogator gathers 2 gigabytes of information per minute, and because it’s coming in so fast, it’s difficult to know whether the data is good, Rob said. After three or four days, the team had indications that the system was working well, and it took the entire week before they felt confident about the experiment.

“What I’m excited for is we see a lot of interesting phenomena in this data collection, which will probably be the quietest dataset with the fewest amount of ice quakes or wave action,” Rob said. “Once we start to see the ice break up and icebergs crashing into each other in other seasons when there’s no ice up there at all, we’ll see things better like tides, currents and storms.” 

Solar balloons

CONTINUED FROM PAGE 1

solar panels or wind turbines, has several advantages over those renewable energy sources, including the ability to store energy in the form of heat before converting it into electricity for the power grid.

One concentrating solar **power plant in Arizona** uses molten salt to store this heat for six hours, while other plants, in theory, could store heat for days or weeks, said Cliff, Sandia’s concentrating solar power expert. This would help power companies even out the daily and seasonal variation of power produced by solar panels and wind turbines.

The **falling-particle receiver** works by dropping dark, sand-like ceramic particles through a beam of concentrated sunlight, then storing the heated particles. These round particles are inexpensive, costing about \$1 for 2.2 pounds, and can get a lot hotter than conventional molten-salt-based concentrating solar power systems, which increases efficiency and drives down cost. **DOE’s goal** is to get the cost of electricity from concentrating solar power down to



UP, UP AND AWAY — Three tethered balloons were deployed both upwind and downwind of the solar tower during a falling-particle receiver test. The team, led by Cliff Ho, found that the concentration was of tiny particles, finer than talcum powder, that escape from the receiver were much lower than EPA limits.

Photo by Randy Montoya



GETTING READY — Dari Dexheimer, Sandia's tethered-balloon expert, and her team prepare the 22-foot-wide, tethered, helium balloons for launch on a gorgeous fall morning. **Photos by Randy Montoya**



SKY HIGH — The Sandia team attaches dust-catching aerosol sensors to a tethered balloon.

five cents per kilowatt hour, comparable to conventional fossil-fuel-based power.

However, the reused particles can eventually break down into fine dust. The Environmental Protection Agency and the Occupational Safety and Health Administration regulate tiny dust particles, finer than talcum powder, that are known to pose a risk for lung damage.

"The motivation for doing the particle sampling was to make sure that this new technology for renewable energy wasn't creating any environmental- or worker-safety issues," Cliff said. "There are particles being emitted from the falling-particle receiver, but the amounts are well below the standards set by the EPA and National Institute for Occupational Safety and Health."

Using tethered balloons to catch dust

Last fall, the research team used sensors sitting a few yards away from the falling-particle receiver on the platform of the solar tower, or **National Solar Thermal Test Facility**, as well as sensors hanging from 22-foot-wide, **tethered, helium**

balloons to measure the particles that were released as it was operating at temperatures above 1,300 degrees Fahrenheit.

Dari Dexheimer, Sandia's tethered-balloon expert, and her team deployed one balloon a little less than a football field away upwind of the solar tower and two balloons downwind to detect dust particles far away from the receiver. One downwind balloon was a little more than a football field away and the other was more than two football fields away. The downwind balloons floated at about 22 stories high — a bit taller than the solar tower itself — and the upwind balloon was a little lower than that.

The balloons and their tethers were outfitted with a variety of sensors to count the number of dust particles in the air around them, as well as their altitude and precise location. The tethered balloons stayed at their specified altitude for three hours, allowing the team to collect a lot of data. They also operated a small remote-controlled balloon that was far more mobile in terms of altitude and position, Dari said.

"That allowed us to collect data every

second for three hours over the entire area," said Dari, who generally flies tethered balloons over northern Alaska to collect data for Arctic climate monitoring and modeling. "Since we got the data in real time, we could move the tethered balloons in order to measure in the highest intensity region of the plume, identify where the plume edges were or track the whole movement of the plume with time."

The team also placed a variety of sensors on the solar tower platform, mere yards from the falling-particle receiver. These sensors could count the number of dust particles as well as determine their size and characteristics.

Andres Sanchez, a Sandia expert on measuring fine particles suspended in air, led these tests as well as similar tests two years ago, together with his colleague Andrew Glen.

For the most recent tests, the researchers constructed special seesaw-like tipping bucket collectors to measure both the amount of particles and their sizes. Somewhat like a tipping bucket rain gauge, particles in the air would go down

a funnel and land on the seesaw-like platform. Once a certain weight of dust particles built up on the platform, it would tip over and send an electrical signal to the researchers. The number of tipping signals in a certain amount of time told the researchers the frequency of particle-emission events, and after the test they could weigh the particles in the bottom of the buckets to determine the collected amount.

Computer modeling and dust mitigation


Comparing the results from sensors close to the falling-particle receiver and those further away on the balloons, they found that the concentration was of tiny particles, finer than talcum powder, was much lower than EPA limits.

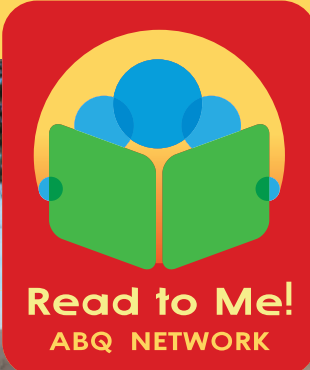
They found that the concentration of dust particles depended upon prevailing weather conditions. They detected dust particles further away from the solar tower on windy days, and higher concentrations of dust particles close to the solar tower on calm days, Andres said. Cliff added that when the wind was blowing into the receiver from the north or northwest, that produced the most dust particles.


“We did some computer modeling using the [EPA’s particle dispersion model](#),” Cliff said. “Basically, it would take an emission of particles 400 times greater than what we found in previous tests to start to get close to the EPA standards. Based on our measurements and models, I don’t foresee any conditions where we’re really hitting those thresholds.”

From the tests, and the computer modeling simulations, the team was able to develop several different methods to reduce the emission of fine dust particles. First, they optimized the shape and geometry of the falling-particle receiver to reduce particle loss, Cliff said. They developed a [stairlike system](#) that slows the particles in the receiver as they fall and a “snout” that helps mitigate the impacts of wind on the falling particles.

They also explored and eventually discarded two other ideas. One was to have a window over the falling particles, because it would get too hot from the concentrated sunlight and was not easy to scale up to large sizes. The other was to protect the

 Sandia National Laboratories






2021 CHILDREN'S


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particles with an air curtain, like those used at store entrances to keep the hot or cool air inside the store.

“I normally focus on atmospheric measurements and modeling how the atmosphere would respond if carbon dioxide emissions are reduced by a particular amount,” Dari said. “With this work, I was able to take part in the active reduction of

those emissions. I think we’ve all really enjoyed seeing the other side of the coin, figuring out how to make renewable energy more efficient and more feasible.”

The balloon tests were funded by the DOE’s [Solar Energy Technologies Office](#) as one of three teams testing different high-temperature concentrating solar power systems with built-in heat storage. 

Labs host events to engage girls of all ages in STEM

By **Katrina Wagner**

To mark Women's History Month, Sandia coordinated three STEM events for girls of all ages, with hundreds of participants.

"Knowing that women are vastly under-represented in STEM careers, I feel like we have an opportunity at Sandia to expose many girls, all ages, from all different backgrounds to STEM careers at a national lab," said community relations specialist Kayla Norris.

The first online event — "Building the Future - Women in STEM" last month was aimed at elementary school age girls. More than 80 families from California and New Mexico participated in the interactive event, which was cohosted by Scientific Adventures for Girls, Stanford University and Sandia.

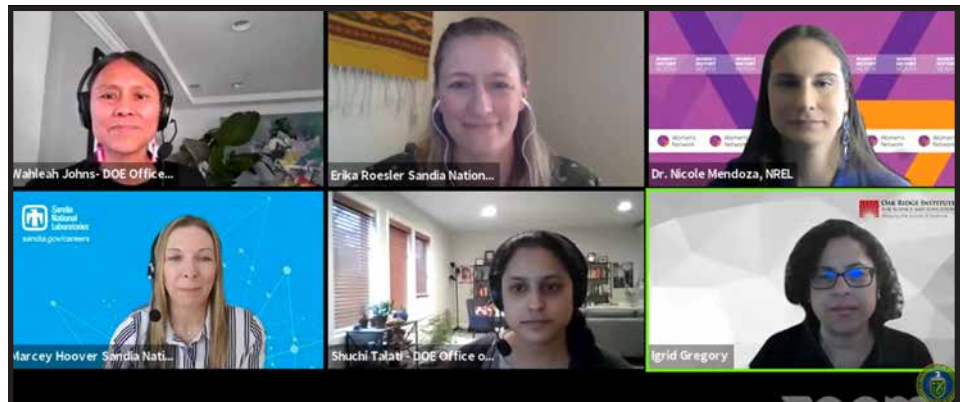
Women STEM professionals led such activities as building geodesic domes out of toothpicks and gumdrops and, under the watchful eye of Sandia chemist Nalini Menon, creating flubber soap from shampoo and cornstarch. Other activities included learning about watersheds from environmental technical professional Nora Wintermute and watching a live demonstration of an electron microscope.

Other Sandians teamed with DOE External Affairs to deliver the [Women in Climate Action Careers](#) panel session on March 31 for high school students in disadvantaged areas and college students at minority-serving institutions and community colleges. Almost 300 participants from across the country were able to learn from women spearheading climate-related projects. Marcey Hoover, director for energy and homeland security program management, moderated the event and panelists included Sandia climate scientist Erika Roesler and representatives from DOE and the [National Renewable Energy Laboratory](#), who discussed education and career opportunities in climate science.



MAKING FLUBBER SOAP — Students make their own hand soap using corn starch and shampoo during the "Building the Future – Women in STEM" online event.


Photo by Adam Wagner



CLIMATE CAREER CONVERSATION — Panelists discuss the importance of battling climate change and the wide range and variety of jobs and career pathways for climate action careers.

Video still courtesy of Kayla Norris

Around 30 middle-school-aged girls from California and New Mexico engaged in an interactive problem-solving virtual event last week, led by Chen Wang, Sandia's Jill Hruby postdoctoral fellow, and a team of other Sandia women professionals and seniors from

Dublin High School. The exercise was created from the Sandia [Portal for Readiness Exercises and Planning tool](#). The girls worked in teams representing various professional roles to tackle a bubonic plague outbreak scenario. 

\$25M solar award

CONTINUED FROM PAGE 2

“It was sort of like an **XPRIZE competition**, with multiple teams competing to deliver a bold solution to a global problem,” Cliff said. “It was exciting.”

Conventional CSP systems use molten nitrate salt to transfer and store heat. However, molten salt decomposes at about 1,100 degrees F, and freezes at about 400 F, requiring expensive trace heating to prevent solidification.

In 2018, **three teams were selected** to compete using alternative liquid, gas and solid media pathways to design a next-generation CSP system that could economically and reliably deliver temperatures above 1,300 F for advanced power cycles. DOE funded other institutions for research and development in each of the three pathways.

Cliff’s team led the efforts to design a **Gen 3 Particle Pilot Plant** and spent the first two years reducing key component risks of the particle-based CSP system, developing a final design of the G3P3 system and performing technoeconomic analyses of a commercial-scale system.

DOE’s announcement said that, “solid particles provided the most promising pathway” to achieve the desired higher temperatures for CSP plants and to meet

2030 electricity cost targets of five cents per kilowatt hour. The primary factors that DOE considered were technical maturity of the heat-transfer pathway and key components, potential to achieve the 2030 cost targets, and the quality and likelihood of success of the proposed construction and test plan.

Cliff said that, following the successful design of G3P3, objectives for the next phase are to construct, commission, test and operate a multi-megawatt falling-particle receiver system that provides six hours of energy storage and heats a working fluid to greater than 1,300 F.

Cliff likened the G3P3 system to a gigantic hourglass filled with sand, except the particles are small, dark ceramic particles of roughly 0.3-0.4 millimeter that are manufactured for hydraulic fracking in the oil and gas industry. G3P3 will be built at the National Solar Thermal Test Facility next to the existing 200-foot tower so that it can use the existing heliostat field and infrastructure.

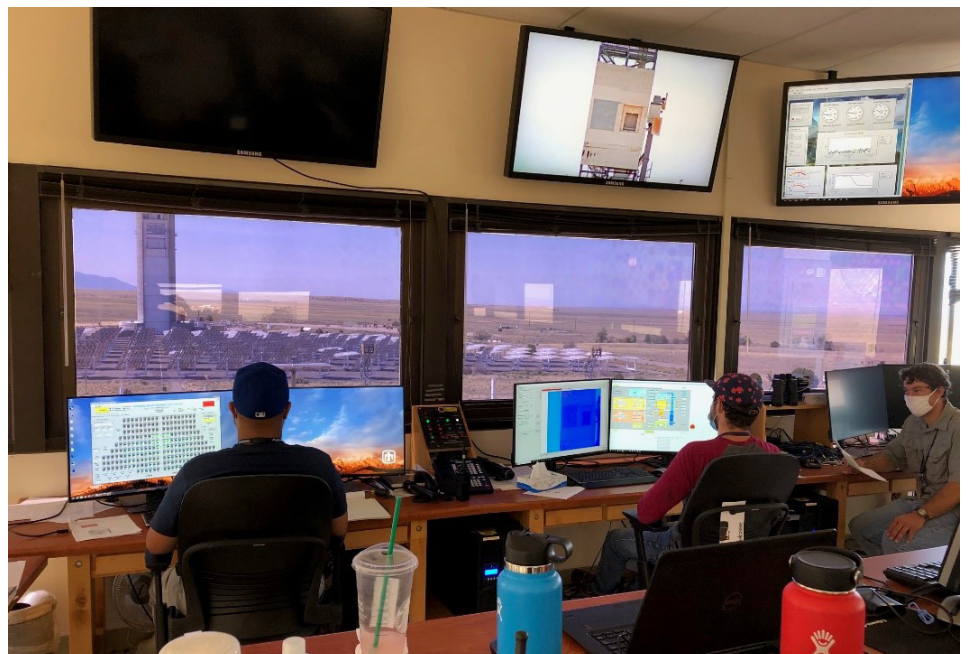
In the G3P3 system, particles fall through an open cavity on top of a tower and are irradiated by a beam of concentrated sunlight from a large field of heliostats — mirrors that track, reflect, and focus the sunlight like a magnifying glass to about 1000-2000 times the normal irradiance of the sun. The falling particles

are heated rapidly to nearly 1,475 F and then collected in a storage bin for use on demand, even when the sun is not shining.

When energy is needed, particles are flowed through the bottom of the storage bin to a heat exchanger, where the particles heat supercritical carbon dioxide to more than 1,300 F. Supercritical carbon dioxide is a working fluid used in advanced **sCO₂ Brayton cycles being pursued by DOE and industry**. The cooled particles are collected in a separate storage bin before being lifted back to the top of the system using a bucket elevator or skip hoist. In the vertically integrated tower, movement of particles throughout the system is driven entirely by gravity except for the particle lift, which reduces parasitic pumping costs associated with liquid- and gas-based CSP systems.

DOE Secretary Jennifer Granholm announced the \$25 million award, during a **“100% Clean” webinar**. It is part of a \$128 million package to national labs, universities and businesses to lower costs, improve performance and speed deployment of solar energy technologies, all aimed at achieving DOE’s ambitious decarbonization goals.

Key contributors to the project include Kevin Albrecht, Jeremy Sment, Brantley Mills, Nathan Schroeder, Henk Laubscher, Luis Garcia Maldonado, Francisco Alvarez, Scott Garcia, Rip Winckel and



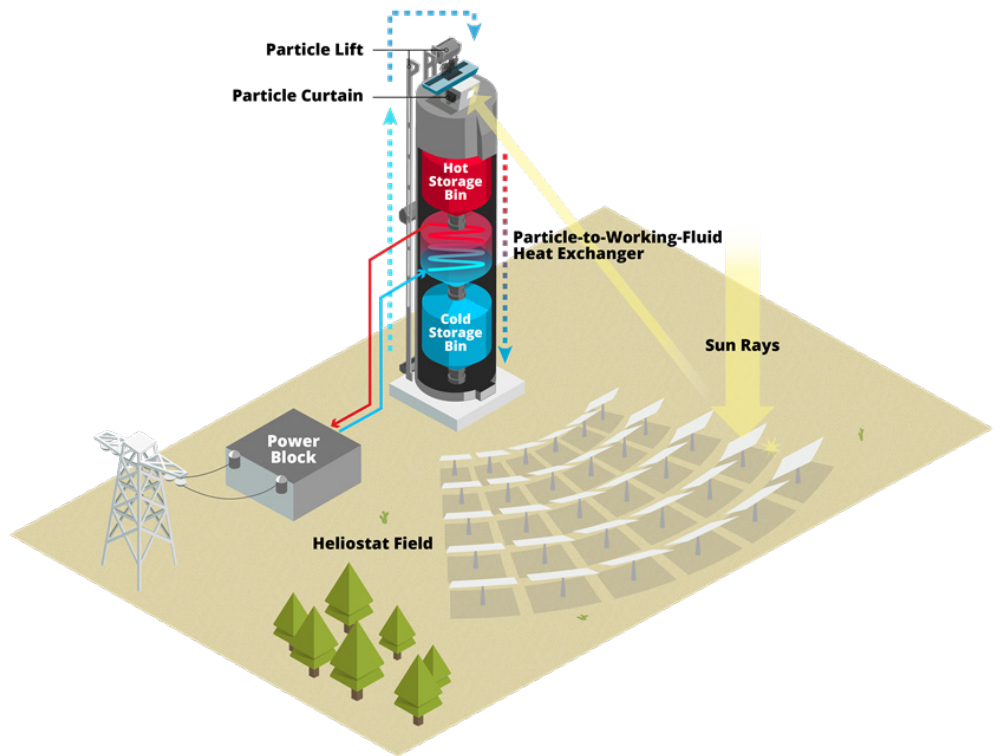
DEVELOPING THE PHASE 3 DESIGN — Falling particle receiver testing takes places at Sandia’s National Solar Thermal Test Facility. **Photos by Cliff Ho**

Scott Rowland. The technologists who supported testing were Daniel Ray, Kevin Good, Robert Crandell, Lam Banh, Benson Tso and Roger Buck.

As part of the G3P3 project, Cliff said that Sandia worked with its large network of international and domestic partners to reduce risks to the particle components and system features, including the receiver, storage bins, heat exchanger, particles, and system controls and integration.

The global effort included key partners in Australia —the Australian Solar Thermal Research Institute-Commonwealth Scientific and Industrial Research Organization, Australian National University and the University of Adelaide; Germany —German Aerospace Center, or DLR; France — CNRS-PROMES; Spain — Polytechnic University of Madrid; Italy — Magaldi Power; Canada — Solex Thermal Science; and Saudi Arabia — King Saud University and Saudi Electricity Co.

Cliff said that a number of U.S. industries and manufacturers, and research institutions,



BRINGING CSP TO MARKET — A sketch of a commercial particle-based CSP plant. Sandia's team competed using a solid media pathway to design a next-generation CSP system that could economically and reliably deliver temperatures above 1,300 F for advanced power cycles.



CERAMIC CURTAIN — Particles fall inside the receiver during testing.

Photo by Randy Montoya

have participated in or provided services for G3P3, including: Allied Mineral Products; CARBO Ceramics; Bohannon Huston; Bridgers & Paxton; EPRI; Georgia Institute of Technology; Materials Handling Equipment; Matrix PDM; Olds Elevator; SolarDynamics; University of New Mexico; and Vacuum Process Engineering.

In addition to decarbonizing electricity production, Cliff said G3P3 can contribute to decarbonization in other areas.

“Developing particle-based CSP technologies provides a unique opportunity to reduce greenhouse gas emissions across multiple energy sectors to address the Biden administration goals for tackling climate change,” he said.

“These include industrial process heat, which contributes to nearly 20 percent of greenhouse gas emissions for manufacturing, chemical processing, and materials synthesis; electricity production, which contributes to nearly 30 percent of greenhouse gas emissions; and transportation fuels, which contributes to nearly 30 percent of emissions,” Cliff said. “CSP also offers the ability to provide economical, large-capacity, long-duration energy storage, which will be important with increasing penetration of intermittent renewables.”



HOT COMMODITY — Sandia researcher Cliff Ho holds CARBO ceramic particles. The falling particles are heated rapidly to nearly 1,475 F and then collected in a storage bin for use on demand, even when the sun is not shining. **Photo by Randy Montoya**

More information about Sandia's [Concentrating Solar Power](#) program is available at [Generation 3 Concentrating Solar Power Systems](#), or visit the [NSTTF](#). [@](#)

Electronic learning courses now open to Sandia

By **Shelley Kleinschmidt**

Sandia has begun offering employees access to Skillsoft Percipio, the popular educational and career development learning platform.

The platform presents more than 7,000 video-based, online courses on topics ranging from communication skills, inclusion and diversity, leadership and project management to new technologies such as artificial intelligence, blockchain and machine learning. Course selections include multiple options for both employees and managers on the topic of remote work.

Talent Management and Development is encouraging all employees to register individually in Skillsoft Percipio, view the Skillsoft introduction video, explore the site, and get started taking courses they're interested in without cost.

Employees can use Skillsoft to take entire courses to increase their skills or simply view segments of a course to find an answer or solve a problem.

Skillsoft's Technology and Developer course collection also is available by request only for those who need more advanced courses in such areas as data

science, machine learning and computer programming.

Employees can log in at <https://sandia.percipio.com>. [@](#)



Virtually perfect: Sandia sponsors four teams to DOE Science Bowl

By **Michael Ellis Langley**

Would you know the correct sequence of calcium, chlorine and magnesium in increasing order of atomic radius?

Those who do competed in this year's Sandia-sponsored Middle School and High School Regional Science Bowls. More than a dozen middle school teams

and 24 high school teams from Clovis to San Diego participated in the two Sandia/CA-sponsored regionals earlier this year.

In California, Winston Churchill Middle School in Carmichael won first place among younger teams, followed by Windemere Ranch Middle School in San Ramon in second place and Granite Ridge Intermediate School in Clovis. Los Alamos

Middle School in Los Alamos beat 10 other teams from five schools to win the New Mexico competition.

Dougherty Valley High in San Ramon, California, took first place honors in the Bay Area Regional, followed by two teams from Mission San Jose High School in Fremont in second and third. La Cueva High in Albuquerque was the best of seven teams from three New Mexico schools.

Volunteers made virtual bowl work

Coordinator Tim Shepodd said dozens of volunteers from Sandia, Lawrence Livermore National Lab and elsewhere — as well as 40 volunteers in New Mexico — had to learn alongside the students about how to conduct the Science Bowl virtually.

“We have 50 officials from Sandia and other places who had to learn a new job,” Tim said. “We had two cameras on each team, one on their faces and one on their environment to make sure they weren’t using phones. One official reads the questions, one official watches the teams and one records the official scores.”

The high school and middle school teams also had to adapt, and did it well, Tim said.

“You do get to see the students’ reactions online and they seem comfortable with the virtual format,” he recalled. “You can see the ‘damn it’ and ‘hooray’ kind of moments for them.”

In the virtual format, each team was read a fixed set of questions at the same time. The scorers tallied the correct answers to determine the winners.

Cheryl Garcia coordinated the competition in New Mexico and said the virtual aspects didn’t cause much difficulty, but noted that fewer schools participated than in years past.


DOE helped beam in volunteers

Tim said that Sandia received plenty of support from the National Science Bowl organization at DOE before and during the competitions.

“If we were short a volunteer, we just had to reach out to the national office to find a volunteer from somewhere in the country,” he said, adding that he felt the competition was a real success. “You do miss the energy of in-person competition. Some of the esprit de corps is missing. But yes, I think it was. It was different and it worked.”

Tim said he was grateful that so many Sandians volunteered their time and energy to help administer the Science Bowl.

The Department of Energy National Science Bowl, for winning teams from all over the nation — including Winston Churchill Middle School and Dougherty Valley High School — will be held virtually on May 8 and May 22. To learn more about Sandia’s sponsorship of the Science Bowl and schools in each community, [click here](#).

The answer, by the way, to the question above, one of the sample questions students could study, is chlorine, magnesium and then calcium. 

Dougherty Valley High School - Team 1 - 1st Place



WHIZZES — A team from Dougherty Valley in San Ramon, California won the High School Regional Science Bowl competition on March 6.

Image courtesy of Martha Campiotti



BOUND FOR NATIONALS — The team from La Cueva High School in Albuquerque won the New Mexico High School Regional Science Bowl competition on March 6.

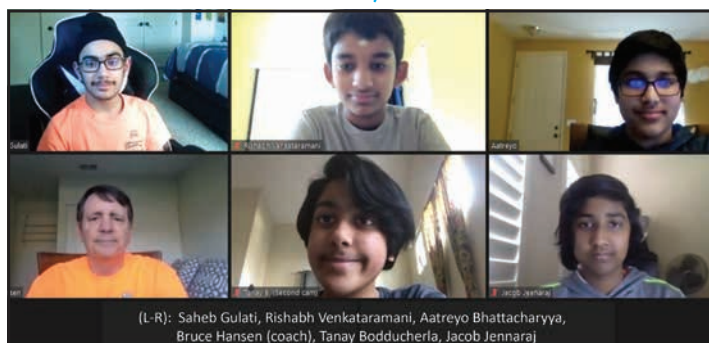
Image courtesy of Cheryl Garcia

Winston Churchill Middle School Sandia Virtual Regional Science Bowl Jan. 30, 2021



TOP PERFORMERS — The members of the Science Bowl team from Los Alamos Middle School are all smiles following their victory on Jan. 30.

Image courtesy of Cheryl Garcia



CHAMPS — The members of the Science Bowl team from Winston Churchill Middle School in Carmichael, California celebrate their victory on Jan. 30.

Image courtesy of Martha Campiotti

Zero Waste by 2025 program seeks to boost recycling

By **Dan Ware**

The warmer days of April invite people outside to enjoy nature. Earth Day is a time to celebrate the environment and pledge to protect it, and an important element of that commitment is mindfulness about waste and recycling.

In 2008, Sandia created the Zero Waste by 2025 goal as a grass roots movement, following a DOE mandate for its sites to reduce half of non-hazardous solid waste by 2015. Because Sandia was on schedule to meet that requirement ahead of time, a new objective was created to divert 90 percent of non-hazardous waste by 2025, said Labs' environmental professional Kelly Wiese.

The program met a lot of success initially, Kelly said. By the early 2010s, Sandia was diverting approximately 65 percent of waste from the landfill, but the program stagnated.

"Over time, people can become blind to messaging, so we are now in the process of coming up with new and innovative ways to reach the workforce," said Kelly.

Part of that effort is researching what resonates with Sandians who are looking for reasons to recycle.

"We've found that messages affect people in different ways," Kelly said. "We realized that we need to determine what motivates people to adopt and maintain pro-environmental behaviors, like recycling."


Recycling thoughts

She said messages might aim to make people think about the environment that will be left for the next generation, or about savings from some recycling streams, or how recycling is an individual responsibility and is the right thing to do.

Kelly said the Labs Waste Management and Pollution Prevention Department works with other organizations such as Creative Services to learn better ways to identify which materials should go into on-site recycling containers. The group recently deployed compost bins in Tech Area 1 for paper towels but not other kinds of waste such as gloves, masks or food containers.

One issue for recycling programs is that many people may not be aware of what they can and cannot recycle, so the [Zero Waste by 2025 website](#) provides information about the difference between recyclables and actual waste. Additionally, the City of Albuquerque's [Solid Waste website](#) has information and a phone app that offers area residents information on how to properly recycle.

Another obstacle to recycling may be access to recycling containers due to their locations in larger buildings. Kelly said the team examines a lot of different options and recommendations for improvement are always welcome.

"Our waste reduction goal is a community effort that can be achieved by each member of the workforce making a small change in their daily habits," she said. "Our past waste audits show that 69 percent of materials thrown away on our campus could have been recycled and 28 percent could have been composted. That leaves only 3 percent of actual waste, so we know there is room for improvement." 



TRASH TALK — Only a tiny fraction of the trash tossed out at Sandia cannot be recycled, as revealed in this waste audit that estimated percentage of recyclable materials members of the workforce are sending to the landfill.

Graphic by Michael Vittitow



HUNTING RECYCLABLE TREASURE — Staff from engineering solutions conduct an audit of waste collected from the Sandia campus and off-site leased buildings.

File photo courtesy of Pollution Prevention

Mileposts



Laney Kidd

35



LeAnn Miller

35



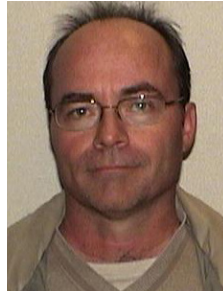
Norma Lauben

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Rita Gonzales

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Alan Williams

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Jesse Baldwin

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Jamie Cash

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Jeremy Cordova

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Bill Engleman

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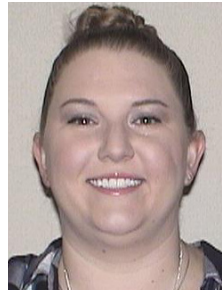
Lanny Gilbertson

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Jianjun Lin

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Shere Mann

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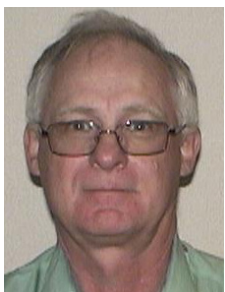
Jason Millard

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Jeanne Oselio

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Gary Shoemaker

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Ashley Amparan Pena

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Adam Rowen

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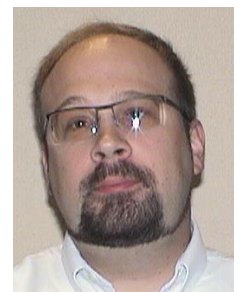
Matt Sceiford

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Will Atkins

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Jim Bronder

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Jim Chantler

15



Dan Clayton

15



Steve Farmer

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Pamela Schorzman

15



Adam Church

15



Jason Hamlet

15

Recent Retirees



Mario Ramirez 42



Michael Johnson 39



Gloria Christensen 37



Ed Russick

37



Margaret Harvey

36



James Lauffer

35



Tom Corbet

30



Barbara Lewis

24



Jane Zingelman

21

Legendary licenses

Sandia tech transfer expert garners national award

By **Manette Newbold Fisher**

Licensing expert Bob Westervelt, who has worked to transfer Sandia technologies in the medical, solar and hydrogen production fields, received the national 2021 Outstanding Technology Transfer Professional Award from the Federal Laboratory Consortium.

The consortium, a network that honors significant technology transfer accomplishments among more than 300 federal laboratories and research centers, recognized Bob at a virtual award ceremony earlier this month. Among his many achievements recognized by the consortium are several creative licenses for New Mexico tech companies and an innovative license prioritization procedure for Sandia.

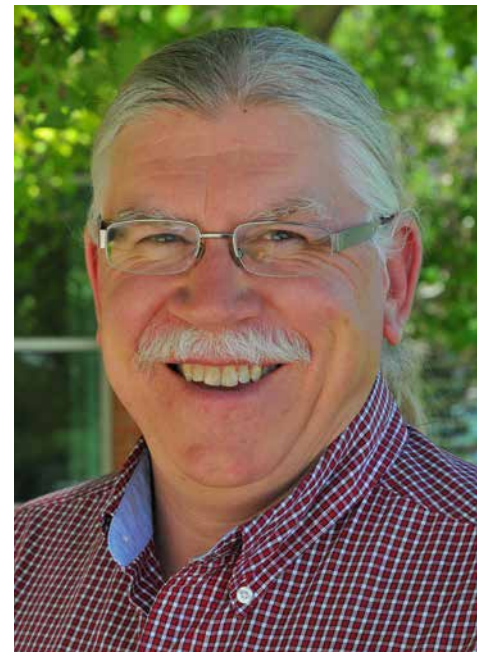
“Bob came to Sandia with a unique set of knowledge and skills in science, business and licensing, which is perfect for his current role,” said Joel Sikora, Sandia manager of technology partnership agreements. “He’s a valuable staff member, and as an expert in software, patents and licensing, he’s helped us think critically in terms of impact when it comes to technology, so

that businesses ideally get the best return on investment when they manufacture and distribute products and services that often have the potential to increase national security or benefit the economy.”

License successes boost Sandia's mission, NM economy

Bob was instrumental in licensing the **X-Ray Toolkit, or XTK**, an image-processing and analysis software developed at Sandia that is used by the military, bomb squads and emergency response teams. Technicians use the software with scanners to look inside and analyze suspicious objects. Bob said Sandia offers the software to military and law enforcement for free. In addition, no-cost test and evaluation licenses were provided to X-ray scanner manufacturers so they could make sure XTK worked with their hardware. Companies willing to give high-quality training to end users could also obtain low-cost licenses.

“The X-Ray Toolkit was always one that I’ve been particularly proud of,” he said. “Thousands of people are using XTK all across the United States, and in the last few



ABOVE AND BEYOND — Sandia National Laboratories license expert Bob Westervelt recently won the 2021 Outstanding Technology Transfer Professional Award from the Federal Laboratory Consortium.

Photo by Randy Montoya

years, it’s been transitioning internationally. There are bomb techs all over the world who are starting to use XTK.”

Bob is also proud of licenses that went to New Mexico start-ups such as **Eden Radioisotopes**, a company working to build a reactor that will produce medical isotopes; **BayoTech**, a company that makes

mobile hydrogen generators; and **mPower**, which is developing flexible solar cells smaller than the width of human hair.

“People aren’t generally aware of New Mexico’s start-up activity, but some of these companies have done really well raising money,” he said. “They’re at different stages, and we’ve been able to evolve the licenses along with how the companies have changed to make sure that they have the foundation to be successful. It will be nice to see three big, successful companies come out of the licenses.”

Concept gives priority to high-impact licenses

Bob also created the concept High Value Licensing, which has been utilized at Sandia to prioritize licenses that will have the most impact. It works by analyzing potential license opportunities by those that are routine, those that are important to Sandia’s national security mission, those that could have financial return, and others that are high-risk, high reward.

“As a manager, I greatly value the High Value License framework because it has improved our commercialization potential,” Joel said. “The framework was based on an analysis of our previous years’ licensing activity and enables us to balance mission and commercial technology licenses.”

While the group looks at financial value of a license, they try to prioritize opportunities that could help national security, even if the developed technology won’t bring in a lot of money. XTK is a good example, Bob said, because it has domestic and international success and makes the world safer.

“The opportunities for the laboratories to work with companies through tech transfer really enables more robust solutions to come out of the laboratory, and we end up benefitting the country,” Bob said. “By engaging with outside partners, it gets the technical staff thinking about the broader focus on problems. Instead of solving one problem, researchers might solve multiple problems. And if solving problems helps the economy, that also helps national security.”

Interest in science, business, novel projects led to Sandia

Originally from upstate New York, Bob said he always had an interest in

science, leading him to earn an undergraduate degree in physics and a doctorate in nuclear physics. His thesis research took him to New Mexico for research at the LANSCE particle accelerator at Los Alamos National Laboratory.

Following graduation from Stanford University, Westervelt continued working on accelerator control systems at Los Alamos before leaving to join a company that licensed software from the lab to develop several types of industrial control systems.

“That gave me the experience with respect to what it takes to make a startup successful, and we had applied technology developed at the national labs for application in something that wasn’t envisioned for when it was first developed,” Bob said. “It’s very fulfilling when technology that you’ve been working on makes it into everyday applications and gets used broadly. We had a map of all of our customers so we could see all the places that were using it.”


After about nine years, Bob left to join a digital imaging company as a chief technology officer, where he combined the company’s technology with technology licensed from larger companies, then integrated the combination into customers’ printers and copiers.

“So, on one side, I was seeing what it takes to deal with licenses from big companies, and then how to license it to our customers,” he said.

Bob was heavily involved in negotiations when part of that company and its intellectual property sold.

He found his next opportunity at Sandia in 2012.

“I was looking for interesting projects to work on as opposed to a particular venue or location. I think that’s what led me through my career path and how I ended up at Sandia,” he said, adding that the position sort of took him full circle, back to a national laboratory with a strong science and technology focus.

“Licensing at Sandia gives you the opportunity to see all of the different types of technologies, the problems that they’re applied to, and what they could be applied to in the future. I found that a particularly interesting challenge to take on.” 



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Sandia networks with Bay Area businesses

By **Michael Ellis Langley**

Sandia California is getting some attention from Bay Area commercial interests in the hopes of developing partnerships that may yield new innovation opportunities.

From April 27-29, Sandia will participate in the second networking event of 2021 put on by the Bay Area Lab Innovation Networking Center, a collaboration between Sandia, Lawrence Livermore and Lawrence Berkeley national laboratories and SLAC National Accelerator Laboratory. The LINC project is part of the DOE Office of Technology Transitions program, [Practices to Accelerate the Commercialization of Technologies](#).

The first virtual event in January drew 1,224 registrants, more than half from startup companies. Participants from large and small Bay Area businesses and universities signed up to learn more about how the labs can help provide resources and technical assistance on a variety of potential products and services.

The January LINC networking session received more than 100 questions, many asking how to partner with the labs, as well as dozens of inquiries made directly through the [LINC website](#) or another DOE portal seeking help with specific technical challenges.

“LINC’s goal is to increase collaboration between businesses and the national laboratories in the San Francisco Bay Area,” said senior manager Mary Monson. “Businesses can benefit from the funding opportunities, unique facilities and technical expertise found within DOE and the national lab system.”

The LINC event at the end of the month is called “Open the Door to Partnerships” and will feature three short sessions.

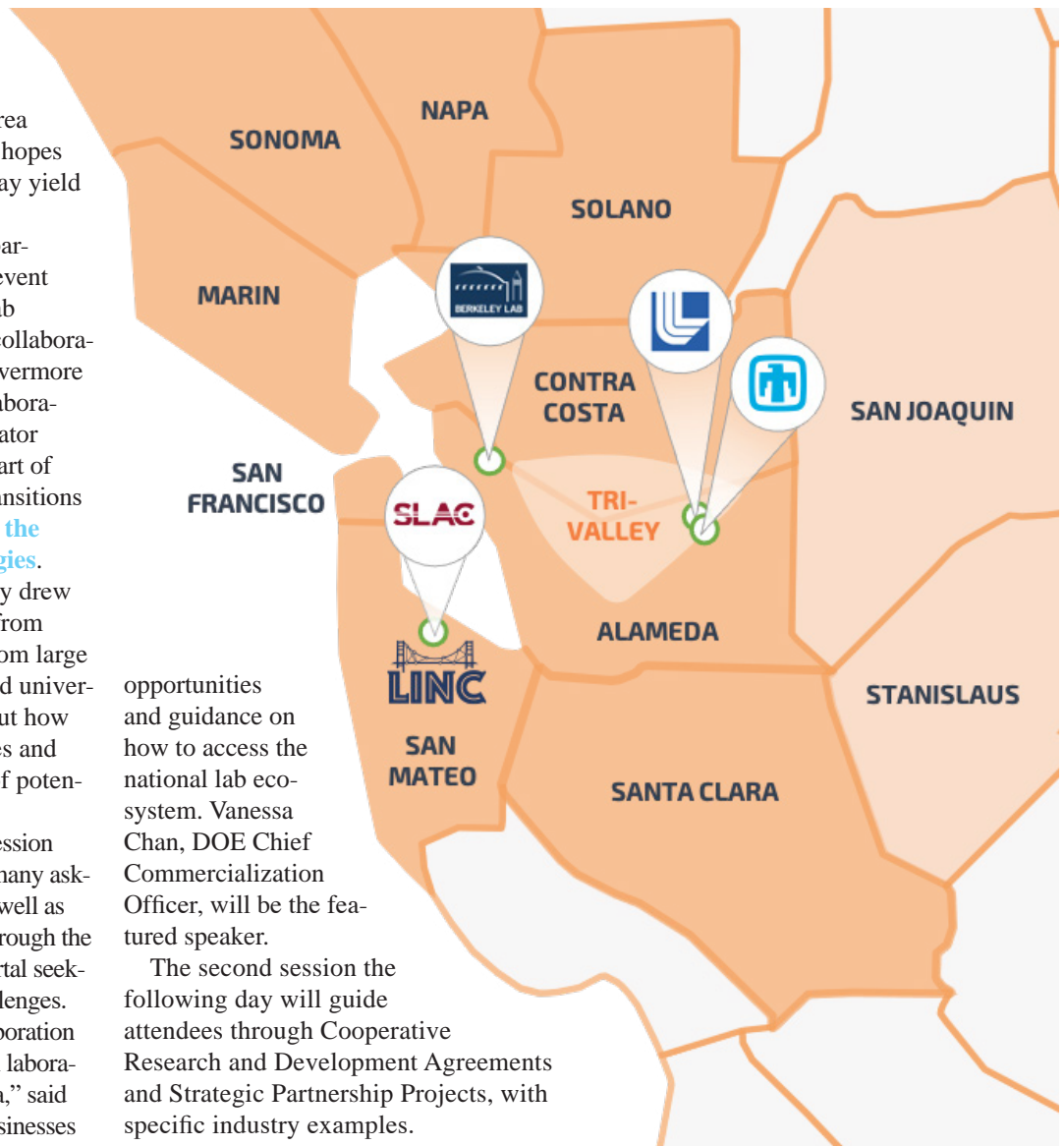
The first session on Tuesday, April 27, features information on DOE funding

opportunities and guidance on how to access the national lab ecosystem. Vanessa Chan, DOE Chief Commercialization Officer, will be the featured speaker.

The second session the following day will guide attendees through Cooperative Research and Development Agreements and Strategic Partnership Projects, with specific industry examples.

The final session on April 29 will feature ways to use research facilities or work with the Bay Area labs in other ways at no cost. It will also highlight how to connect with the broader complex of 17 national laboratories through the DOE Lab Partnering Service.

Participants can register to attend or get more information about LINC [here](#). 



ALL OVER THE MAP — Four national laboratories and the DOE are hosting a three-day workshop through the Bay Area Lab Innovation Networking Center from April 27-29.

Graphic courtesy
Lab Innovation Networking Center

Ask Andy helps ease Facilities workload for managers, staff

By **Valerie McKinney**

A Facilities improvement team is working to ease work for managers, as described at the [#LightenTheLoad](#) website. The team focuses on a variety of manager burdens related to making sure staff have the right places to do their work.

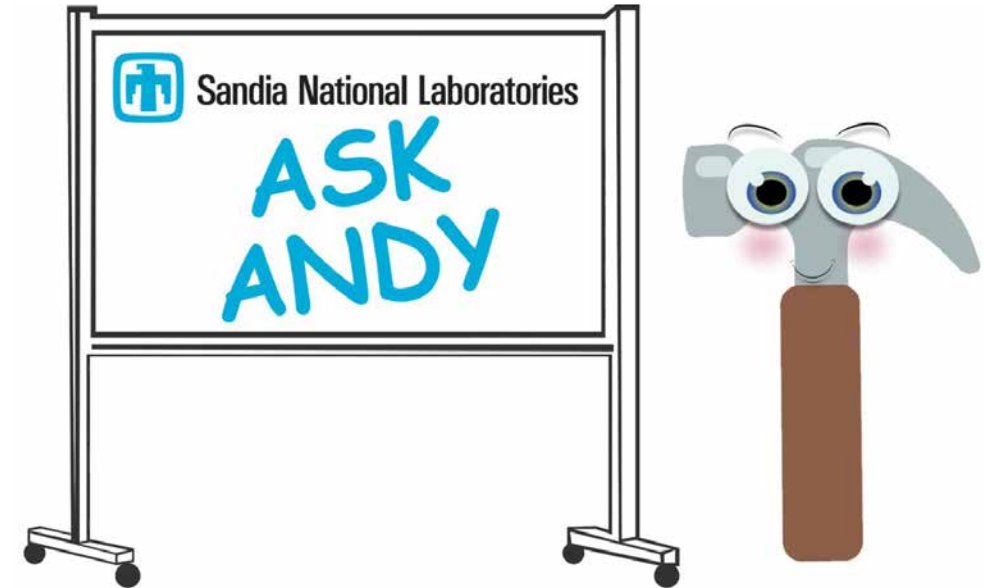
And Andy Hammer is using humor and creativity to play a role in one of those efforts.

He stars in new, short videos that aim to help the managers and the rest of the workforce better understand how to engage with their Facilities team. The videos also emphasize the building manager's integral role.

The "Ask Andy" videos inform the workforce about Facilities services by providing answers to common questions about the Facilities operation. The videos also can be used to stimulate in-person discussions, such as department meetings and tier boards, or function as stand-alone resources.

The videos also will be part of the ongoing email campaign for new employees that Human Resources uses for orientation during their first year.


"Ask Andy is a great way of using humor to address our customers' commonly asked questions," said Robert Thoesen, lead for Work Coordination and Control operations. "I see this as a benefit in that it is somewhat off-beat and unlike the more traditional Labwide communications. There are many difficult conversations and

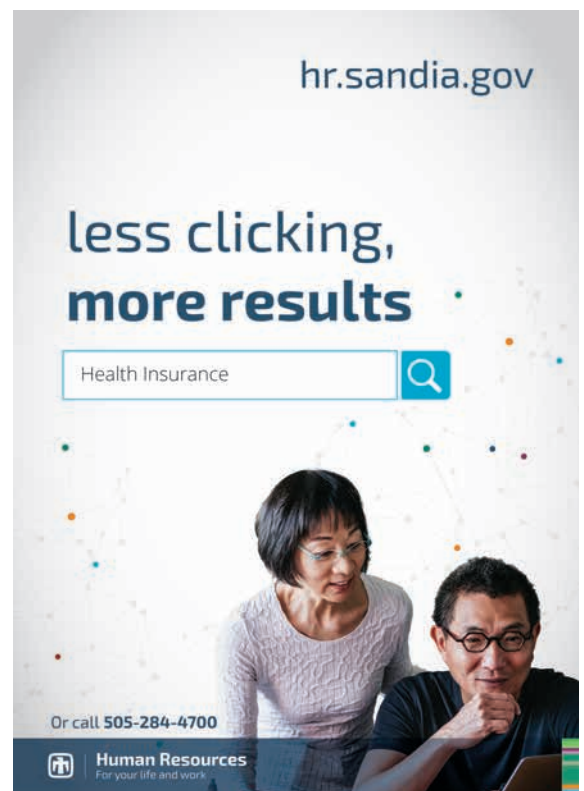


customer service opportunities that Andy may be able to address in a fun and entertaining way."

Looking to find out who your building manager is? Andy has answers. Do you need to know what a FAM (Facilities Area Manager) is? Or are you having trouble finding the service tracker? Andy can help.

"Because my team is large with more than 300 people and dozens of separate locations, the Ask Andy videos communicate much of what ES&H coordinators get asked," said Anita Archibeque, an ES&H coordinator. "For me, this helps to reduce the number of emails, instant messages and phone calls I receive on the subject."

Three episodes of Ask Andy are available now at the [Facilities web-site](#), with more to come. 



On-site vaccine clinics help stomp out COVID-19

Story by **Meagan Brace**
Photos by **Randy Montoya**

Since January 11, Sandia medical staff has worked tirelessly to vaccinate the Labs' workforce against COVID-19 and ensure no vaccine goes to waste.

Starting with medical personnel, first responders and other emergency management staff, they began vaccinating essential workers at Sandia's on-site Medical Clinic before moving to a drive-through clinic at Innovation Parkway Office Center.

As supply increased, Sandia Medical invited eligible members of the workforce to schedule appointments based on the criteria set by the Centers for Disease Control and Prevention and state health departments.

To ensure all circumstances were considered, Sandia developed its own vaccine registration tool that ensured the Labs could determine vaccine priority based on the unique conditions reported by Albuquerque- and Livermore-based employees. By capturing such information as age, chronic medical conditions, caregiver status and other vaccine eligibility criteria, the registration tool helped Sandia Medical further segment on-site essential workers and update its lists to keep up with state phasing requirements.

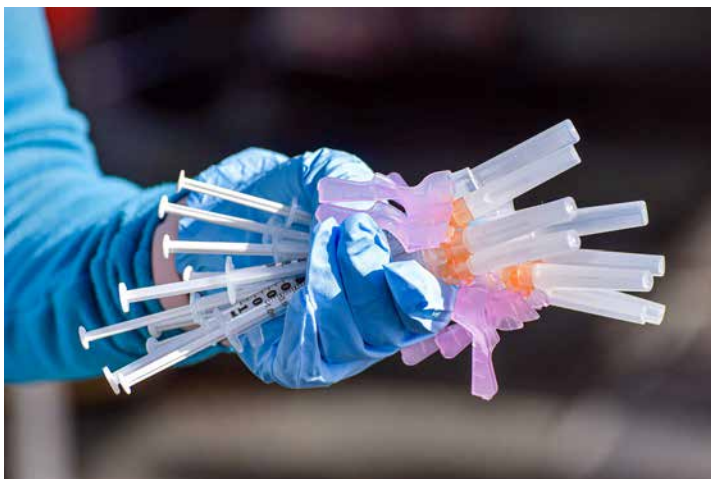
Now, due to nationwide expanded eligibility, Employee Health Services has

moved to open scheduling to make the Pfizer vaccine available to all employees and subcontractors who haven't yet received a vaccine either on-site or through a community provider. First-dose appointments are scheduled through April 29 and second doses will be administered on-site May 12-21. Staff wanting to sign up can use the [scheduling eForm](#).

Sandia's California site has worked closely with Lawrence Livermore National Lab to vaccinate the workforce and began administering vaccine on March 25 after receiving a supply directly from DOE/NNSA. The initial round of vaccines was made available to DOE national lab employees and subcontractors who perform on-site, mission-essential work and are potentially at higher risk because of close contact with other employees, business travel or other risk factors related to mission requirements. [ti](#)

As of April 22, Sandia Medical has fully vaccinated more than 2,500 people, and more than 3,400 people have been fully vaccinated through a community provider. In total, 40% of the workforce, excluding offsite contractors, has been fully vaccinated so far.





This photo by Latonya King