



# Tread tester

Sandia Labs and Goodyear develop ways to test tires before they're built

By **Michael J. Baker**

**S**imulating how a tire's tread, rubber and size respond to a road's corners, angles and hills, Sandia and The Goodyear Tire & Rubber Co. have developed a virtual means of showing a tire's performance before the first prototypes are ever built.

Computer simulations test a virtual tire on a virtual test machine that simulates actual road conditions. Thus, the Virtual Flat Trac reduces the need to test actual tires on Goodyear's actual



**GOOD TIRES** — Sandia computer scientists Vicki Porter, left, and Byron Hanks, seated second from left, and engineers from The Goodyear Tire & Rubber Co. study images of tire technology during a pre-COVID-19 work session at Sandia.

Photo by Jennifer Plante

Flat Trac machines in Akron, Ohio, or Colmar-Berg, Luxembourg, said Michael Skroch, Sandia's manager of Simulation Modeling Sciences.

Forces that the physical Flat Trac measures as it puts a tire through its paces, on a conveyor belt-like machine with

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# Sandia injects \$3.76 billion into economy

Nation, state, small businesses benefit from Sandia purchasing



By **Michael J. Baker**

**D**riven by the purchasing of goods and services and payroll, Sandia injected an all-time high of more than \$3.76 billion into the economy in fiscal year 2020.

“It’s no secret that the second half of the year was tough on a lot of people and businesses, especially smaller companies, which is why we are extremely proud to be able to support local and state communities and companies through our business activities,” said Scott Aeilts, Sandia’s associate Labs director of Mission Services.

More than \$1.4 billion was spent to purchase goods and services from suppliers, including nearly \$482.6 million with New Mexico businesses and more than \$349.7 million in subcontracts with the state’s small businesses.

“We will continue to build on our successes in developing partnerships with highly qualified, diverse suppliers that can

— CONTINUED ON PAGE 5



**MAKING AN IMPACT** — The fiscal year 2020 Economic Impact brochure breaks down Sandia’s spending and spotlights its role in local and national economies.

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

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

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**LABNEWS Notes**

**EDITOR'S NOTE:** We've stopped printing the *Lab News*, but will continue to publish every two weeks. We want you to remain in our community of readers, so please send your comments and suggestions for stories or for improving the paper. *Lab News* welcomes guest columnists who wish to tell their own "Sandia story" or offer their observations on life at the Labs or on science and technology in the news. If you have a column (500-800 words) or an idea to submit, contact *Lab News* editor Jim Danneskiold at [jddanne@sandia.gov](mailto:jddanne@sandia.gov).

# Sandia claims top public relations award

## Labs' 70th Anniversary Campaign wins Best of Show

By **Myles Copeland**

In researching "70 Ways Sandia Has Changed the Nation," Meagan Brace sometimes came across a fact she couldn't wait to share.

"I remember calling my husband and saying, 'Did you know Sandia did this?'" Meagan said, recounting the day she learned the Labs had developed an **advanced bomb squad tool** used to disable Richard Reid's shoe bomb and a device found in the cabin of Unabomber Theodore Kaczynski.

Meagan, a corporate communications specialist, led Sandia Labs' 70th Anniversary Campaign, a six-month blitz during 2019 that capitalized on traditional, digital and social media channels to spotlight Sandia's historical accomplishments.



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**PINNACLE OF PR** — Meagan Brace displays Sandia's Best of Show from the New Mexico Chapter of the Public Relations Society of America's 2020 Cumbre Awards. **Photo by Randy Montoya**

# International research team begins uncovering Arctic mystery

## New study on submarine permafrost suggests locked greenhouse gases are emerging

By **Manette Newbold Fisher**

Something is lurking beneath the Arctic Ocean. While it's not a monster, it's largely remained a mystery.

According to 25 international researchers who collaborated on a first-of-its-kind study, frozen land beneath rising sea levels currently traps 60 billion tons of methane and 560 billion tons of organic carbon. Little is known about the frozen sediment and soil — called submarine permafrost — even as it slowly thaws and releases methane and carbon that could have significant impacts on climate.

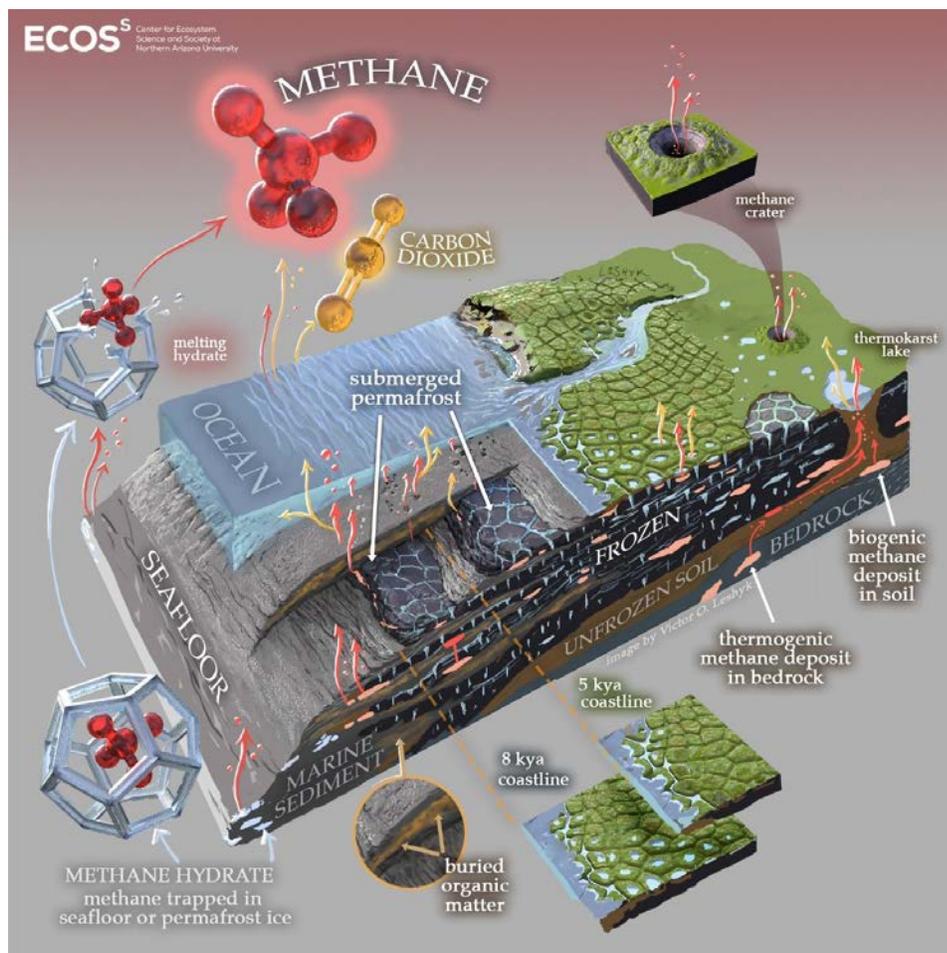
To put into perspective the amount of greenhouse gases in submarine permafrost, humans have released about 500 billion tons of carbon into the atmosphere since the Industrial Revolution, said Sandia geosciences engineer Jennifer Frederick, one of the authors on the study published in [IOP Publishing journal Environmental Research Letters](#).

While researchers predict that submarine permafrost is not a ticking time bomb and could take hundreds of years to emit its greenhouse gases, Jennifer said submarine permafrost carbon stock represents a potential giant ecosystem feedback to climate change not yet included in climate projections and agreements.

“It's expected to be released over a long period of time, but it's still a significant amount,” she said. “This expert assessment is bringing to light that we can't just ignore it because it's underwater and we can't see it. It's lurking there, and it's a potentially large source of carbon, particularly methane.”

### Researchers combine expert analysis on known data

The team of researchers led by Brigham Young University graduate

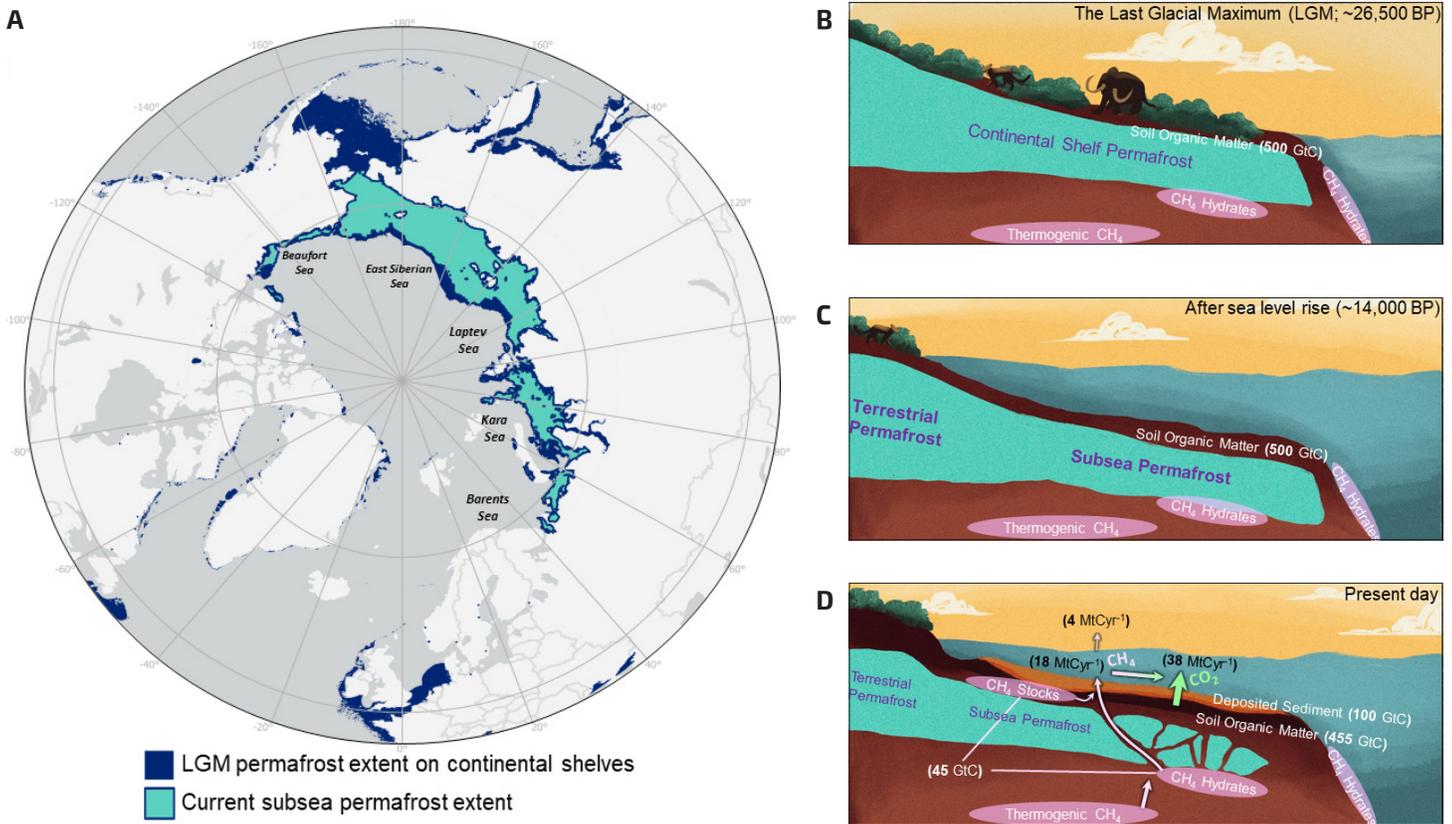


**ARCTIC THAW** — This artistic diagram of the subsea and coastal permafrost ecosystems emphasizes greenhouse gas production and release. **Artwork by Victor Oleg Leshyk, Northern Arizona University**

student Sara Sayedi and senior researcher Ben Abbott compiled available articles and reports on the subject to create a base analysis of submarine permafrost's potential to affect climate change. The study was coordinated through the [Permafrost Carbon Network](#), which has more than 400 members from 130 research institutions in 21 countries. Participants have experience in all major areas in the subsea permafrost domain and come from a variety of field and modeling backgrounds. Together, they

represent more than 180 cumulative years of research in subsea permafrost.

The study was conducted through an expert assessment that sought answers to several central questions: What is the current extent of submarine permafrost? How much carbon is locked in submarine permafrost? How much has been and will be released? And, what is the rate of release into the atmosphere? The participating experts answered questions using their own scientific skills, which could include modeling, data analysis or literature synthesis.



**FROZEN LAND** — Figure A shows the extent and carbon dynamics of the subsea permafrost domain versus the Last Glacial Maximum. Drawings B-D depict the thermal, physical and biogeochemical changes initiated in the subsea permafrost domain by deglaciation and sea level rise.

Background drawings by Anna Wright, Brigham Young University

Jennifer, one of the original advocates of the study, has been modeling submarine permafrost for almost 10 years and answered the questions through the lens of her research, which is primarily in numerical modeling. She said she uses published material for model inputs or works directly with researchers who visit the Arctic and provide datasets.

Her work on the study was funded by the [Laboratory Directed Research and Development program](#) that enables Sandia scientists and engineers to explore innovative solutions to national security issues. The program serves in part as a proving ground for new concepts in research and development and fosters scientific discovery to propel the Labs' missions.

Jennifer's work aligned with Sandia's [Arctic Science and Security Initiative](#). For more than 20 years, the Labs have had a presence in northern Alaska, said Sandia atmospheric sciences manager Lori Parrott.

## Models are based on more than 20 years of atmospheric data

Working for the DOE Office of Biological and Environmental Research, Sandia manages the Atmospheric Radiation Measurement user facility centered at Utqiagvik, or Barrow, Alaska, that collects atmospheric data continuously. Researchers measure and predict the speed of de-icing at the North Slope to help federal leaders make decisions on climate change and national security. In addition, Sandia creates accurate models for both sea and land ice and develops technologies for greenhouse gas monitoring. With more than 20 years of data, researchers can begin to decipher trends, Lori said.

"I hope this study begins to unite the research community in submarine permafrost," said Jennifer. "Historically, it's not only been a challenging location to do field work and make observations, but language barriers and other obstacles in accessibility to the existing observations and literature

has challenged international scientific progress in this area."

The team estimates that submarine permafrost has been thawing since the end of the last glacial period 14,000 years ago, and currently releases about 140 million tons of carbon dioxide and 5.3 million tons of methane into the atmosphere each year. This represents a small fraction of total human-caused greenhouse gas emissions per year, about the same yearly footprint as Spain, Sayedi said.

However, modern greenhouse gas releases are predominantly a result of the natural response to deglaciation, according to the study. Experts suggest that human-caused global warming may accelerate greenhouse gas release, but due to lack of research and uncertainties in this area, determining causes and rates of the release will remain unknown until better empirical and modeling estimates are available.

"I'm optimistic that this study will shed light on the fact that submarine permafrost exists, and that people are studying its role in climate," Jennifer said. "The size of the

research community doesn't necessarily reflect its importance in the climate system."

Almost every expert involved in the study mentioned the permafrost knowledge gap, which makes it harder for scientists to anticipate changes and reduces the reliability of estimates of carbon pools and fluxes, as well as the thermal and hydrological conditions of permafrost. Jennifer said that

while there is a wealth of ongoing research on terrestrial permafrost, submarine permafrost hasn't been taken on like this before, and hasn't been the subject of nearly as much international collaboration.

The amount of carbon sequestered or associated with submarine permafrost is relevant when compared to the numbers of carbon in terrestrial permafrost and what's

in the atmosphere today, Jennifer said.

"This is an example of a very large source of carbon that hasn't been considered in climate predictions or agreements," she said. "While it's not a ticking time bomb, what is certain is that submarine permafrost carbon stocks cannot continue to be ignored, and we need to know more about how they will affect the Earth's future." 

## Economic impact

CONTINUED FROM PAGE 1

contribute to our national security mission and help us return that investment to the communities, the states and the country that we serve," Scott said.

In addition, the economic impact included nearly \$1.67 billion in payroll from Oct. 1, 2019, to Sept. 30. Sandia added about 460 new positions last year, helping to raise the number of Sandia employees above 14,400.

Other highlights in the [2020 Sandia Economic Impact brochure](#) include:

- Sandia's more than \$3.76 billion in spending was an increase of more than \$86.8 million compared to fiscal year 2019.
- More than \$1.4 billion was spent on goods and services — including about \$1.33 billion in subcontract payments and roughly \$72.5 million in procurement-card purchases.
- Sandia paid nearly \$100.3 million in corporate taxes, an all-time high of about \$98 million being in gross receipt taxes to the state of New Mexico in fiscal year 2020.
- The Labs spent nearly \$2.26 billion on labor, including payroll, and other nonsubcontract related payments. That was up about \$91.2 million from fiscal year 2019.

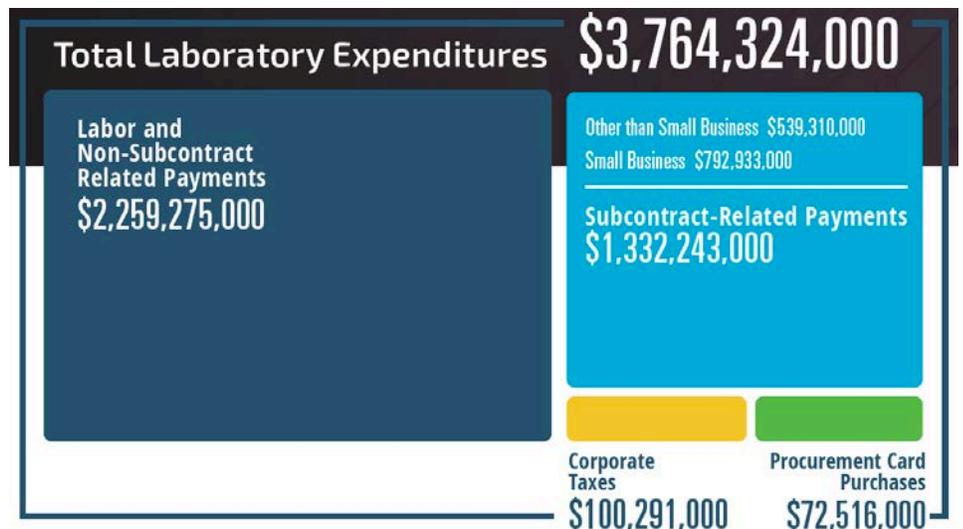
### A history of strong commitments to small businesses

The data showcases Sandia's long-standing commitment to small businesses, which received more than \$792.9 million, or 59.5%, of the more than \$1.33 billion spent on subcontract awards in fiscal year 2020. Subcontracting with all small



**BUSINESS CIRCLE** — Judy Ortiz Rizek is owner and president of The Circuit Shop in Albuquerque, a small, woman-owned business that contracts with Sandia. The company makes printed circuit boards for a variety of departments at the Labs and is International Traffic in Arms Regulations certified.

Photo by Randy Montoya



**SPENDING DETAIL** — The fiscal year 2020 Economic Impact Brochure breaks down Sandia spending among several categories.

businesses was up nearly \$8.8 million compared to fiscal year 2019.

New Mexico businesses received nearly \$473.1 million in subcontracts, or 35.5% of

the total subcontracting amount. New Mexico small businesses received about 74% of those subcontract payments. With an additional \$9.5 million in procurement-card purchases,

Sandia spent about \$482.6 million with New Mexico businesses in fiscal year 2020.

A run of strong years with New Mexico businesses helped to balance a minor dip in the state's small business spending when compared to an exceptionally strong fiscal year 2019. Subcontract spending was down about \$14.2 million with the state's small businesses, although still above fiscal year 2018 and previous years. Since fiscal year 2016, Sandia's contracting with New Mexico small businesses has increased by about \$109.9 million.

"Fiscal year 2019 was a strong year bolstered by multiple large, one-time, New Mexico subcontracts, such as with contractors working on the **Astra super-computer**," said Paul Sedillo, Sandia small-business program manager.

"The COVID-19 pandemic was a blow to so many, especially small businesses, but the nearly \$483 million spent by Sandia within the state of New Mexico last year helped the economy during a difficult time," Paul said. "Spending in New Mexico remains strong, and that is a great thing."

Sandia focuses on working with small businesses fitting the federal categories as small disadvantaged, women-owned, veteran-owned, service-disabled veteran owned, and small businesses in impoverished, HUBZone areas.

## Helping small businesses grow

One of those small businesses is Hacienda Home Centers, with offices in Albuquerque and stores in Española and Las Vegas, New Mexico. The provider of maintenance, repair and operations products plus building materials is also in the process of opening a store, HHC Supply, near Kirtland Air Force Base that caters to businesses and government agencies.

"It's been very easy to work with Sandia, from the contract administrators to the people making requests for materials," said Joe Sanchez, vice president of Hacienda Home Centers.

"It's been tough lately for small businesses," he said. "The contract with Sandia has really helped us to continue to grow. It gives us confidence to expand."

Hacienda, a HUBZone, veteran-owned small business, signed a contract with Sandia about five months ago after attending several small-business forums hosted by the Labs before the coronavirus pandemic, Sanchez said.

## The drive continues for small and diverse suppliers

Sandia seeks out small businesses through a variety of programs, such as public forums attended by Hacienda, other suppliers and

civic leaders to discuss subcontracting opportunities. In fiscal year 2020, Sandia launched a **Mentor-Protégé Program** for small businesses and recently named its **first three protégés**. Last fiscal year, 41 new contract opportunities offered the **5% New Mexico pricing preference**. Contracting opportunities are listed on Sandia's **website**.

For the past four years, Sandia has hosted small-business forums to meet with business owners and representatives. In fiscal year 2020, before the pandemic, Sandia hosted two such events attended by 129 suppliers that could meet with subcontract professionals, supplier diversity advocates, other Sandia personnel and representatives of a free New Mexico small business resource center, the **New Mexico Procurement Technical Assistance Center**. Sandia representatives attended 12 virtual small-business events last fiscal year.

"It is hard work and resiliency that make small businesses special," Paul said. "That's why Sandia is dedicated to working just as hard to ensure that small and diverse businesses have every opportunity to work with Sandia National Labs. Small businesses are vital to the Labs and our nation."

In fiscal year 2020, Sandia added 548 new small businesses to its supplier base. In all, small businesses represent 70% of all Sandia suppliers. 

## 2020 Cumbre Awards

*CONTINUED FROM PAGE 2*

On a mission to showcase the Labs' once low-profile history, the team transformed the information into more than a **hundred posts** unique to four social media platforms, a 36-page **print publication**, an accompanying 71-page external website, and seven news articles that provided in-depth accounts of Sandia's inception, infrastructure and historic contributions.

The New Mexico Chapter of the Public Relations Society of America recognized the campaign with its highest honor, Best of Show, at the annual Cumbre Awards, announced virtually on Nov. 19, 2020.

Sandia claimed eight Cumbre Awards for seven different projects:

- Sandia National Laboratories' 2019 Economic Impact; and New Labs

Director News Conference (Gold Awards for Tactic)

- Vignettes: Just Because You Can, Doesn't Mean You Should (Gold Award for Tactic)
- Solar Tower Virtual Event (Silver Award for Tactic)
- 2019 High Performance Computing Report (Silver Award for Tactic)
- Union Negotiation Communications (Gold Award for Campaign)
- Sandia's Labs' 70th Anniversary (Gold Award for Campaign; Best of Show)
- Eubank Gate Security Improvement Project (Bronze Award for Campaign)

NMPSA Board Chair Hilma Chynoweth said, "Sandia's impressive take at the 2020 Cumbre Awards reflects top-notch communications campaigns and tactics."

The work of a large team of writers and designers, the 70th Anniversary

Campaign benefitted from contributions by Valerie Alba, Randy Bill, Meagan, Jim Danneskiold, Tim Deshler, Darrick Hurst, Jonathan Marney, Karli Massey, Randy Montoya, Doug Prout, Thomas Poyer, Jennifer Sawayda, Noela Teague, Rebecca Ullrich and Michael Vittitow.

"Sandia has incredibly dedicated and talented communication professionals working every day to spread word of the amazing work being done by our brilliant workforce," said Director of Communications Frederick Bermudez. "It's an honor to be recognized by our peers from throughout the state." 



## Tread tester

CONTINUED FROM PAGE 1

sideways turns and acceleration, can be modeled with Sandia's high-performance computing codes.

"Tire construction and forces on the tire can be simulated with Sandia's codes as part of a virtual design cycle, which helps reduce engineering time and time-to-market for Goodyear," Michael said. "Our partnership with Goodyear in this work improves Sandia's capability for the nuclear deterrence mission."

The Virtual Flat Trac is one of the latest innovations in a nearly three-decade partnership between Sandia and Goodyear that is the Labs' longest-running **Cooperative Research and Development Agreement**, or CRADA.

Working to perfect simulations that include multiple rotations, millions of different interactions between elements, complicated tire structures and wear, temperature and pressure conditions can be extremely complex. But the challenges also advance algorithms and software that contribute to Sandia's high performance computing and nuclear stockpile efforts.

"Sandia also has strong interest in virtual testing for better efficiency and accelerated design for nuclear deterrence engineering and stockpile stewardship," Michael said. "This deepens our win-win partnership in this work going forward."

For **Goodyear**, there is also a tangible result: Virtual Flat Trac was instrumental in the selection of Goodyear tires for two key vehicle models expected to begin production in 2022.

"The Virtual Flat Trac modeling using the Sandia codes was an essential part of a package we delivered to a major automotive original equipment manufacturer in order to secure new business. We have had numerous wins with the Sandia technology over the years; this is one example with a direct business impact," said Tom Ebbott, Goodyear's R&D Fellow for Modeling and Simulation.

### Modeling in the virtual world

The Virtual Flat Trac was developed using Sandia's Sierra suite of analysis codes, said



**KICKING THE TIRES** — The MTS CT Plus Flat Trac, a tire test that measures forces on a moving tire, is pictured here. Sandia has worked with Goodyear to develop Virtual Flat Trac. **Photo courtesy of Smithers.**

Vicki Porter, the Labs' Goodyear technology liaison.

Designers enter the tire's geometry, material composition, inflation and tread pattern, along with the vehicle load on the tire. They then predict things like the temperature of the tire, road noise and how it feels for the driver holding the steering wheel during cornering and at various speeds.

"For example, you can virtually inflate a tire, roll it through cornering maneuvers to see what kind of reactions you get to such things as the rim of the tire," Vicki said. "You can do more testing virtually, and you get a lot more knowledge of the physics behind the tire response."

The algorithms used to simulate the effects of parts rubbing and sliding, impact loads and prescribed velocities are used



**SIMULATED TURN** — Sandia has worked with Goodyear to develop the tire modeling input for Goodyear's new vehicle simulator.

**Photo courtesy of Goodyear Tire & Rubber Co.**

to inform similar tests run on components developed by Sandia for use with the nuclear stockpile. "It allows for Goodyear to get a tire on a vehicle faster; for Sandia, it gets us to production faster," Vicki said.

Goodyear recently installed a new state-of-the-art dynamic driving simulator. This will

## Mileposts



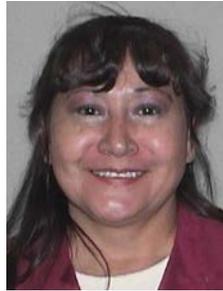
Alicia Cloer 40



Linda Gallagher 40



Mario Martinez 40



Martina Cox 35



Dennis Croessmann 35



Robert Urias 35



Valerie Mascarenas 30



Adam Cook 20



Chad Davis 20



Armando Fresquez 20



Cyndi Pepe 20



Valerie Peyton 15



Jason Sonnek 15



Fabian Warren 15

provide an avenue for the Sandia tools that are used to virtually predict tire response to be combined with a vehicle model and a road course or track model. Drivers can understand and assess vehicle handling response virtually, reducing the building or testing of prototype tires, Ebbott said.

### Sandia on the long road in automotive developments

Sandia and Goodyear have worked together since 1992 and signed their first CRADA in 1993.

An early victory for the collaboration was a unique all-weather tire with a three-part tread compound, the Assurance TripleTred, launched in 2004. The Sandia codes played a principal role contributing to the design and on-time launch of this critical addition to Goodyear's product line. The recent Virtual Flat Trac application to outfit two key 2022 vehicle models demonstrates how the collaboration continues to produce wins.

"Over the last 28 years, the main thing that we've been collaborating on has been computer code development," Vicki said. "Tires are one of the most effective safety features on a vehicle."

Several of the Labs technologies have played a role in the CRADA, including advanced computational mechanics, sophisticated geometry and meshing, computational simulation and verification, elastomeric materials, structural and tire dynamics, advanced manufacturing of rubber products, efficient characterization methods for structural dynamics, reliability tools for manufacturing processes, sensor systems, data science, human reliability and cybersecurity.

While the agreement to work with Goodyear is Sandia's longest running CRADA, tires are just one example of the Labs' technologies and capabilities that can be used for automotive applications.

Such work includes reducing emissions through improved combustion science and fuels, more efficient ducted fuel injection, increasing battery storage safety and efficiency at the Battery Abuse Testing Laboratory, improving lithium battery performance for electric vehicles, advancing material and coating technology and developing hydrogen and fuel cell technologies critical for realizing a clean and secure energy future.

## Recent Retirees



Penny Jones 41



Larry Schoof 31



**CARBON FIBER** — Brandon Ennis holds a carbon fiber plank, a new material that could bring cost and performance benefits to the wind industry.

Photo by Randy Montoya

# Carbon fiber for wind turbine blades could bring cost, performance benefits

*Sandia study aims to spur innovation between two separate industries*

By **Melissae Fellet**

**A** new carbon fiber material could bring cost and performance benefits to the wind industry if developed commercially, says a study led by Sandia researchers.

Wind blades containing carbon fiber weigh 25% less than ones made from traditional fiberglass materials. That means carbon fiber blades could be longer than fiberglass ones and, therefore, capture more energy in locations with low wind. A switch to carbon fiber also could extend blade lifetime because carbon fiber materials have a high fatigue resistance, said Brandon Ennis, a wind energy researcher at Sandia and the principal investigator for the project.

The project is funded by DOE's Wind Energy Technologies Office in the Office of Energy Efficiency and Renewable Energy. Partners include Oak Ridge National Laboratory and Montana State University.

Of all the companies producing wind turbines, only one uses carbon fiber materials extensively in their blade designs. Wind turbine blades are the largest single-piece composite structures in the world, and the wind industry could represent the largest market for carbon fiber materials by weight, if a material that competed on a cost-value basis to fiberglass reinforced composites was commercially available, said Brandon.

However, the wind and carbon fiber industries do not currently overlap. The wind industry designs wind turbine blades using only commercially available

materials and carbon fiber manufacturers face a hurdle to innovation due to high capital costs associated with introducing a new production line for the wind industry.

## **Novel low-cost carbon fiber has properties useful for wind**

Cost is the main consideration during component design in the wind industry, yet turbine manufacturers also have to build blades that withstand the compressive and fatigue loads that blades experience as they rotate for up to 30 years.

Brandon and his colleagues wondered if a novel low-cost carbon fiber developed at Oak Ridge could meet performance needs while bringing cost benefits for the wind industry. This material starts with a widely available precursor from the

textile industry that contains thick bundles of acrylic fibers. The manufacturing process, which heats the fibers to convert them to carbon, is followed by an intermediate step that pulls the carbon fiber into planks. The plank-making pultrusion process creates carbon fiber with high performance and reliability needed for blade manufacturing and also allows for high production capacity.

When the research team studied this low-cost carbon fiber, they discovered it performed better than current commercial materials in terms of cost-specific properties of most interest to the wind industry.

Oak Ridge provided developmental samples of carbon fiber from its Carbon Fiber Technology Facility and composites made from this material as well as similar composites made from commercially available carbon fiber for comparison.

Montana State University colleagues measured the mechanical properties of the novel carbon fiber versus commercially

available carbon fiber and standard fiberglass composites. Then Brandon combined these measurements with cost modeling results from Oak Ridge. He used those data in a blade design analysis to assess the system impact of using the novel carbon fiber, instead of standard carbon fiber or fiberglass, as the main structural support in a wind blade.

### Increased compressive strength brings cost savings

Brandon and his colleagues found that the new carbon fiber material had 56% more compressive strength per dollar than commercially available carbon fiber, which is the industry baseline. Typically, manufacturers accommodate a lower compressive strength by using more material to make a component, which then increases costs. Considering the higher compressive strength per cost of the novel carbon fiber, Brandon predicted about a 40% savings in material costs for a spar cap — the main

structural component of a wind turbine blade — made from the new carbon fiber compared to commercial carbon fiber.

The novel carbon fiber even reduced predicted materials costs when compared to fiberglass for a land-based turbine design, due to the improved fatigue resistance. Other results from using the novel carbon fiber in blade design, such as decreased weight and increased fatigue lifetime, could influence the entire turbine design in ways that bring additional cost and performance benefits, Brandon said.

“While the optimal carbon fiber for the wind industry does not exist on the market yet, this new textile carbon fiber has performance characteristics that have higher value for the specific loads that a wind turbine experiences,” Brandon said. “Developing this material commercially could enable the benefits of carbon fiber materials to be realized more broadly by the wind industry and lower the overall cost of wind energy.” 

## New tool brings some West Texas wind to the Duke City — virtually

By **Dan Ware**

**S**andia researchers have a new tool that allows them to study wind power, to see whether it can be efficiently used to provide power to people living in remote and rural places or even off the grid, through distributed energy.

A new, custom-built wind turbine emulator has been installed at Sandia’s **Distributed Energy Technologies Laboratory**. The emulator, which mimics actual wind turbines at Sandia’s **Scaled Wind Farm Technology Site** near Lubbock, Texas, will be used to study how real wind farms behave under multiple weather conditions and load demands, and if they can be efficiently used as a source of distributed energy for consumers who live near the farms, said Brian Naughton, a researcher with Sandia’s Wind Energy Technologies program.

Unlike traditional wind farms that feed energy to grid-connected



**EMULATING THE WIND** — Rachid Darbali-Zamora examines Sandia’s new wind turbine motor, which will allow the distributed energy team to study how real wind farms will behave under a variety of conditions and in different locations. **Photo by Bret Latter**



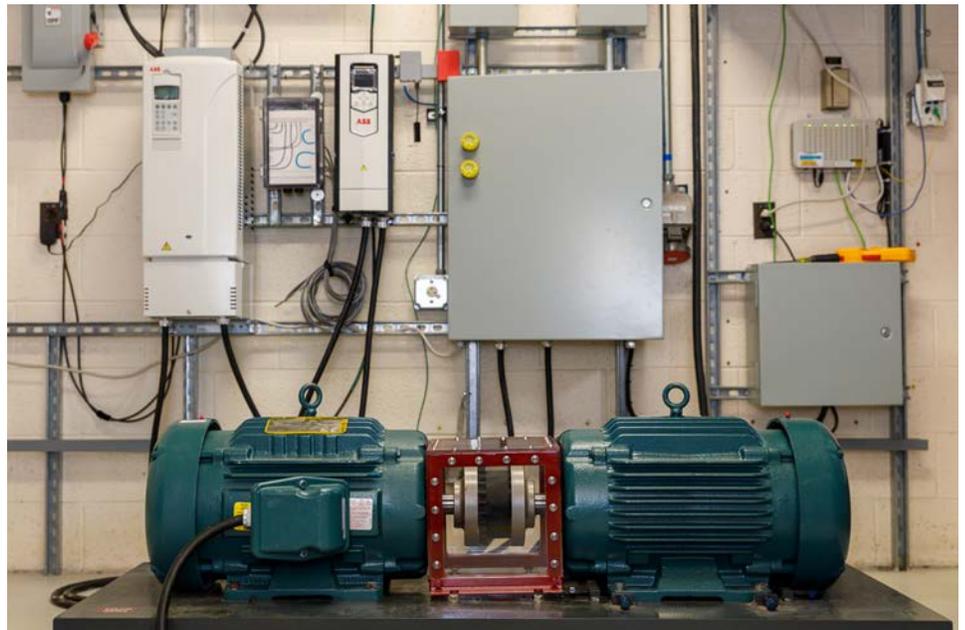
**SMALL-SCALE ZEPHYRS** — Rachid's team will use the scaled-down turbine motor to emulate a variety of conditions and tackle the challenges of using wind power as part of a microgrid for remote communities. **Photos by Bret Latter**

transmission lines, wind turbines used for distributed energy are in close proximity or even directly connected to the end user or customer, Brian said. This is especially important for users who are in remote areas or who are off the main electrical grid.

"Right now, most wind generated power is just sent out on transmission lines to customers hundreds of miles away and can be affected by a wide variety of disruptions," said Brian. "Being able to test how wind turbines react to different and varying wind and weather conditions, we can help determine the viability of having generation take place closer to homes, schools and businesses."

Determining the viability of using wind turbines as a source of distributed energy is important due to the potential impact it could have on providing electricity to remote, islands communities that exist largely off the main electric grid, said Rachid Darbali-Zamora, a researcher with Sandia's Renewable Energy and Distributed Systems Integration program.

"We're looking at finding solutions to challenges faced by parts of the country that cannot be consistently powered by a traditional electric grid, such as remote



**CALM WINDS** — The motor, generator, power electronics and grid connections that make up the wind turbine emulator allow researchers to study the performance of a wind turbine under different wind and grid conditions without the risks and challenges encountered in the field.

communities in Alaska or islands that have experienced crippling devastation due to hurricanes," Rachid said. "Adding wind as a distributed energy source, we are potentially solving some big challenges that are faced regarding the utilization of microgrid technology."

### Faster research through innovation

By using the resources available at the Distributed Energy Technologies Laboratory, researchers will be able to exactly replicate wind, weather and load demand conditions at the Texas site, according to Brian.

“Because the Distributed Energy Technologies Lab is so configurable, we’re able to conduct tests and simulations that are not feasible or safe to do on the actual electric grid or that we might have to wait days or weeks for conditions to be right at the wind farm site,” Brian said. “Just like the lab can simulate weather and load conditions for solar photovoltaics and battery testing, we can now do the same thing for wind generation.”

The emulator consists of a scaled down wind turbine motor and uses much of the same hardware and software that control actual turbines. The motor is connected to the lab’s emulator system, allowing researchers to operate the “virtual” turbine under different conditions, Brian said.

“Because we’ve created an emulator that is as close to the real thing as possible, we can rapidly and cost-effectively go from concept to a solution to the challenges communities and utilities face regarding distributed energy generation,” Brian said. “We also believe that the research we’re going to be conducting will have an overall benefit to grid resilience and stability, which affects everyone.”

## Replicating West Texas wind in real time simulations

In the laboratory setting, a model mimicking the Texas wind farm site’s electrical distribution system is run in real-time, generating approximately 15 kilowatts of electricity. Power from the wind turbine emulator is introduced to the simulated wind farm, influencing its behavior. In turn, responses, such as voltage variations, affect the wind turbine emulator behavior. This also allows the emulator to interact with other physical devices inside the Distributed Energy Technologies Lab such as solar photovoltaic inverters and protection systems, said Sandia’s Jon Berg, of Wind Energy Technology.

“Wind as strong as 25 meters per second interacting with the rotor blades is represented by a motor drive that we can program to duplicate how the rotor speed would respond,” Jon said. “The torque being created then causes the emulator to produce electricity, just like the actual

turbine does, as the turbine control system commands the power converter and generator to resist the input torque.”

Brian, Rachid and Jon all believe that the ability to apply different control schemes to the emulator and simulated environments in real time will help identify obstacles that can arise during deployment in the field such as system communications latencies or other configuration challenges. Being able to address these in a real-time test environment will save time and money and increase efficiency of field deployment.

Funded by [Department of Energy’s Wind Energy Technologies Office](#), the new wind turbine emulator at Sandia is part of the [Microgrids, Infrastructure Resilience and Advanced Controls Launchpad](#), a collaboration between Sandia, the [Idaho](#) and [Pacific Northwest](#) national laboratories and the [National Renewable Energy Laboratory](#). Researchers use the launchpad to advance wind-hybrid distributed energy systems to provide stability, flexibility, security and resilience to distribution systems and microgrids. 

# Adaptability in the year of COVID-19 earns Sandia a 100 Healthiest Employers award

By [Lara Adams](#)

2020 was perilous for health care workers across the globe, from battling COVID-19 in expanded ICUs to adapting to service models that are primarily videoconference based.

Challenges abounded for Sandia as well. But the Labs worked through them to be recognized as one of the top 100 Healthiest Employers, and it ranked among the top five in New Mexico.

Springbuk, a health data analytics company, created the Healthiest Employers program to recognize companies that proactively shape the health of their employees, and to honor the “best of the best” in corporate health and wellness, based on six criteria: vision, expertise, culture and engagement, metrics, learning and technology.

Sandia’s quick adaptation to the pandemic environment and use of technology to continue delivering services was



**VIRTUALLY VIGOROUS** — Sandia participants in an online fitness class, depicted at the bottom of the computer screen, take advantage of one of the many offerings from Employee Health Services.

Photo courtesy of Randy Montoya

a compelling factor, said Renee Holland, director of Employee Health Services. Through videoconferencing platforms, the preventive health team was able to engage with employees virtually for one-on-one appointments and group services.

“We didn’t let the pandemic get us off track,” she said.

Quite the opposite, in fact. In FY20, Employee Health Services reached more unique individual participants than ever. In addition, Sandia’s overall wellness engagement was up 9% from 2019 due to virtual offerings and initiatives across various divisions, said Callie Lovato, coordinator for preventive health.

“We were able to collaborate with California to maximize our resources and deliver services to a larger population of employees,” Renee said.

### Fitness classed doubled

For example, space constraints limited in-person group fitness classes to 26 participants, but once classes went virtual, the number of participants increased significantly. In the first months of the pandemic, classes nearly doubled. Engagement didn’t just increase among the workforce, but for households. “We saw a lot of pictures of kids, cats, and dogs doing yoga,” Renee said.

Adapting to the pandemic-related restrictions ultimately gave employees more options. “COVID-19 taught us what our barriers were,” Callie said. “Coming to a physical class may have been a bigger barrier than we realized between travel time, parking and comfort levels.”

When Sandia moves to increased on-site work, the preventive health team plans to continue offering virtual appointments and classes to accommodate employees working a hybrid workstyle and expand the ability for everyone to participate.

“Sandians should be proud of themselves for continuing to participate in health activities and proud of our team for their resilience and ability to continue engaging with the workforce when they needed it the most,” Renee said.

Increased employee engagement in health programs and services last year speaks to Sandia’s overall cultural commitment to employee health, she said, crediting Sandia’s wellness culture to strong leadership support.



**MORE WAYS TO GET FIT** — Preventive health coordinator Callie Lovato found that more staff took part in the Labs’ wellness offerings during the pandemic year, another reason why Sandia was named one of the top Healthiest Employers.

Photo courtesy of Randy Montoya

“It’s leading by example,” Callie said, “helping us move the workforce toward health.”

Sandia’s 2020 success story wasn’t just reactions to the pandemic, but its offerings, Callie said.

Working with health champions and workplace engagement councils, a dedicated health educator built individual health initiatives for divisions based on their specific health concerns.

“Health is an ever-changing science,” Callie said. “We have a strong history together moving forward. For us that means continuing to evolve our programs based on what employees need and want.”

By analyzing Health Assessment results, Virgin Pulse platform engagement metrics and class participation, the team can

identify health risks, watch trends and plan health education based on what employees need and want. The Healthy Me Program, which focuses on a different health pillar each quarter, is based on the employee population’s risk factors, Callie said. The education and resources provided in each quarter on topics such as nutrition, sleep and exercise help employees make sustainable health improvements.

The theme for Healthy Me 2021 is Adapt. Connect. Evolve. The idea is to acknowledge how Labs staff had to adapt to challenges of 2020.

“The pandemic caused us to stretch and grow,” Callie said. “It pushed many groups to evolve. It taught us a lesson in what is possible.” 