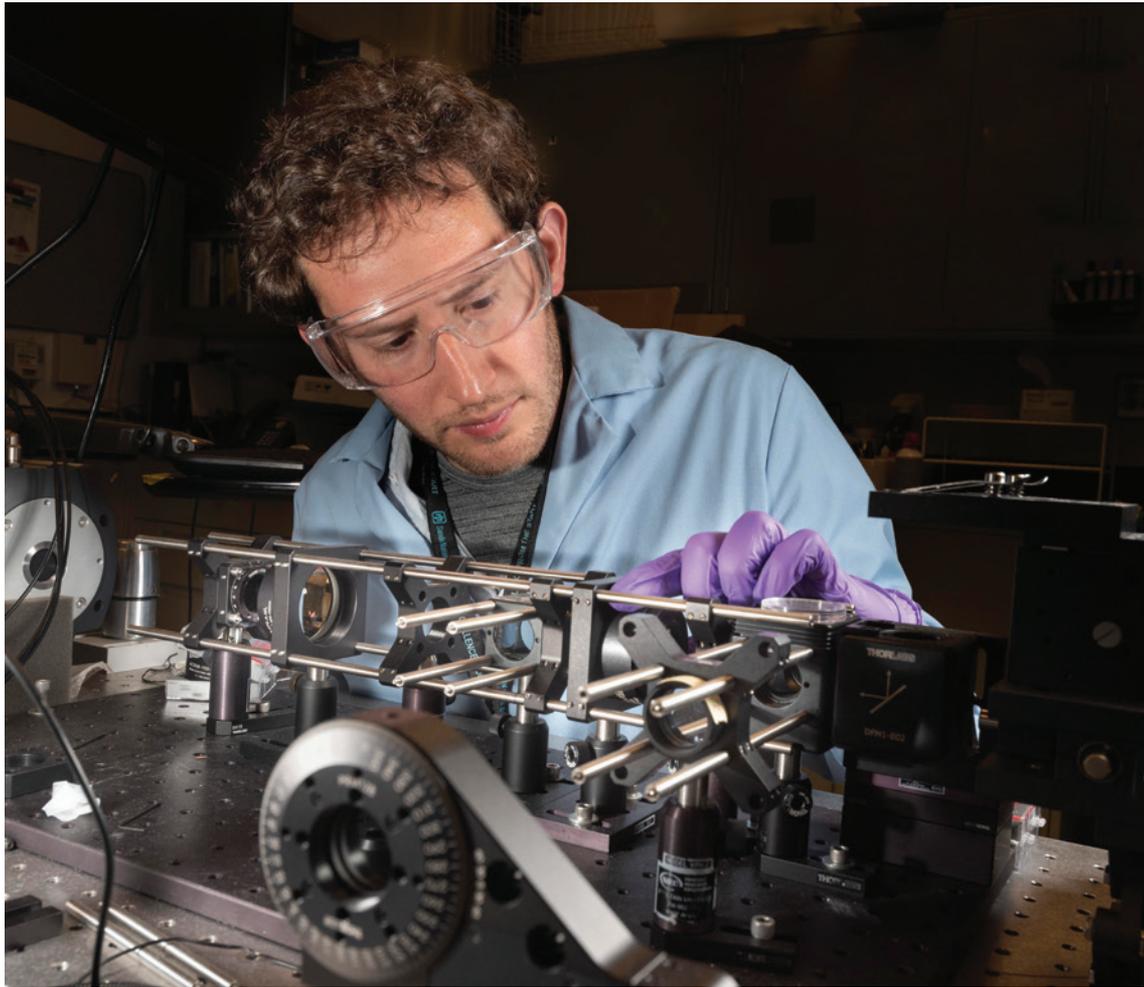




## Advanced microscopy reveals unusual DNA structure



**SEEING STRETCHED DNA** — Sandia optical scientist Adam Backer helped develop an advanced microscopy technique that revealed highly tilted base pairs in a stretched form of DNA. Photo by Randy Montoya

*Pushing technology's limits to observe fundamental feature of stretched DNA*

By **Melissae Fellet**

An advanced imaging technique reveals new structural details of S-DNA, ladder-like DNA that forms when the molecule experiences extreme tension. This work conducted at Sandia and Vrije University in the Netherlands provides the first experimental evidence that S-DNA contains highly tilted base pairs.

The predictable pairing and stacking of the DNA base pairs help to define the molecule's double-helix shape. Understanding how the base pairs realign when DNA is stretched might provide insight into a range of biological processes and improve the design and performance of nanodevices built with DNA. Tilted base pairs in stretched S-DNA have been predicted previously using computer simulations, but never demonstrated conclusively in experiments until now, according to a recent article in *Science Advances*.

DNA is most commonly known as the molecular carrier of genetic information. However, in research labs around the world, it also has another use: construction material for nanoscale devices. To do this, scientists prepare computer-generated

— CONTINUED ON PAGE 11

## AI center to combine hardware, software for practical gains

By **Neal Singer**

Sandia and Pacific Northwest national laboratories and the Georgia Institute of Technology in Atlanta are launching a research center that combines hardware and software design and development to improve artificial intelligence technologies that will ultimately benefit the public.

AI is an emerging field with eventual applications ranging from autonomous vehicles for monitoring wildfires to developing drugs for cancer and treating post-traumatic stress disorder.

The Department of Energy Office of Advanced Scientific Computing Research will provide \$5.5 million over three years for the center, called Artificial Intelligence-focused Architectures and Algorithms.

"The center will focus on the most challenging basic problems facing the young field, with the intention of speeding advances in cybersecurity, electric grid resilience, physics and chemistry simulations and other DOE priorities," said Sandia project lead Siva Rajamanickam, an expert in high-performance computing.

"A codesign center is a wonderful opportunity because people of diverse backgrounds — hardware designers, theoretical computer scientists, mathematicians and domain scientists — come together to develop solutions to a very challenging problem,

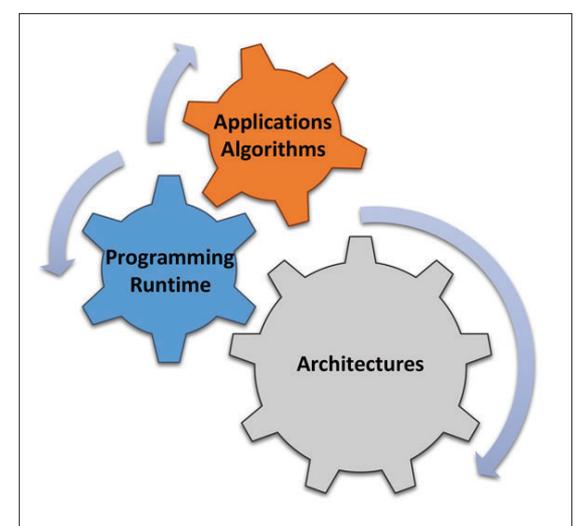
the codesign of machine learning accelerators," Siva said.

### The promise of AI

Artificial intelligence and the subfield machine learning allow computer systems like those in self-driving cars to automatically learn from experience without being explicitly programmed. Such technology can perform tasks that formerly only a human could do: see, identify patterns, inform decisions and respond with actions.

Special-purpose computing devices focused on such machine-learning tasks should encourage rapid deployment of these technologies in several fields, Siva said. Designing such devices, and influencing their design elsewhere, is important to position the United States as a leader in this emerging field, he said.

Not a physical facility, but a collaborative environment, the new center is intended to encourage researchers at the three institutions, each with their own specialty, to simulate and evaluate artificial intelligence hardware when employed on current or future supercomputers and to make improvements when AI and machine-learning methods replace or augment more traditional computation methods, according to ARIAA.



**SYNERGY AT THE CENTER** — Applications algorithms, programming runtime and architectures will all work synergistically in the new ARIAA center.

Image by **Robert Gioiosa (PNNL)** and **Siva Rajamanickam (Sandia)**

The center will work in close collaboration with DOE's newly formed Artificial Intelligence and Technology Office, which was created by Secretary of Energy Rick Perry to coordinate the department's artificial intelligence work and accelerate the research, development and adoption of AI to impact people's lives in a positive way.

— CONTINUED ON PAGE 9



## Sandia celebrates 70th Anniversary!

— Stories and photos, pages 4-7

## Strategic Priority No. 7

### Unleashing Sandia's power

By **Scott Aeilts**, Associate Labs Director, Mission Services; **Mark Sellers**, Associate Labs Director, Mission Assurance; and **John Myers**, Senior Director, Human Resources & Communications

For more than 70 years, Sandia has provided exceptional service in the national interest. What does it take for Sandia, the premier science and engineering laboratory for national security and technology innovation, to become even better? What is our desired future state 10 years from now? What focus areas and investments will unlock Sandia's full potential? These are the questions behind Sandia's Strategic Priority No. 7: Unleash the power of Sandia.

Strategic Priority No. 7 is a call to action to identify better, easier ways to do our job on behalf of the nation. We need to be more agile, make more focused decisions to create and sustain an exceptional institution and remove organizational barriers that are slowing us down and reducing our impact.

To successfully move toward our desired future state, Sandia must become more agile. There are essentially five trademarks of an agile organization: 1) a shared purpose and vision, 2) a network of empowered teams, 3) rapid decision and learning cycles, 4) a dynamic people model that ignites passion and 5) next-generation enabling technology. Each of these trademarks will be used as a metric to gauge our overall success in meeting our vision for the next 10+ years.

In fiscal year 2019, we developed four pillars for Strategic Priority No. 7: 1) **Operational Effectiveness**, 2) **Creative Thinking and Innovation**, 3) **Empowered Workforce** and 4) **Exceptional Institution**. We also created a roadmap to achieve our desired end state by identifying near-, mid- and far-term objectives for each pillar. Moreover, we have engaged with the Labs' other strategy teams to ensure the unleashing initiatives we developed are in alignment with needs from their mission and technical priorities.



From left, Scott Aeilts, Associate Labs Director, Mission Services; John Myers, Senior Director, Human Resources & Communications; and Mark Sellers, Associate Labs Director, Mission Assurance. **Photo by Randy Montoya**

The first pillar, **Operational Effectiveness**, seeks to increase engineering through intuitive, automated and effective operations. Simply put, this will require us to identify operational inefficiencies that are slowing us down as an organization. Several near-term objectives (one- to three-year timeframes) will be recommended to provide solutions that are motivated by, and accountable for, increasing the effectiveness, efficiency and agility of the Labs. Some recommendations include analyzing impacts before implementing change, enhancing search capabilities on the internal Sandia Restricted Network, providing consistently capable and functional conference room equipment and Skype capabilities, and promoting a more advanced service-oriented approach for better internal and external operational experiences.

The second pillar, **Creative Thinking and Innovation**, seeks to provide employees with the space, time and mindset to innovate. This equates to encouraging unstructured time to advance diverse planned and spontaneous interactions and fostering strategic endeavors and creativity for more rapid innovation. Near-term recommendations include providing the time and means for focused creativity, removing unnecessary need-to-know barriers, rewarding staff adaptability and flexibility and increasing our overall innovation output through a more risk-tolerant approach.

The third pillar, **Empowered Workforce**, seeks to ensure that every employee is equipped, trusted and vested in institutional and mission success. This includes diversity and inclusion, as well as an acknowledgement that every member of the workforce is appreciated and valued for their

contribution to the various missions of the Labs. We must unleash the power to foster workforce satisfaction through exciting onboarding and training, world-class opportunities and benefits, wide-ranging flexible career trajectories and promotions and mechanisms for staff expression of ideas, as well as implementing managerial standards and accountability for performance.

The final pillar, **Exceptional Institution**, envisions Sandia as the most agile, responsive and innovative laboratory in the nation by reinforcing Sandia's brand and reputation for exceptional Federally Funded Research and Development Center work. As an institution, we would like to cultivate purposeful research and development through focused attention on clear Labs priorities, as well as provide disinvestment principles for areas that are innovation-exhausted. Some near-term recommendations to pursue include solidifying acceptance of core Labs roles outside weapons work, displaying more agility as an FFRDC and breaking down silos by promoting more cross-disciplinary teaming Labs-wide.

Through advancements in these four pillars, Sandia can unleash transformational changes that advance operations, innovation, workforce satisfaction and our reputation as a leading FFRDC. Several near-term recommendations have been included in the Labs' fiscal year 2020 objectives.

Thanks for letting us share some of the Strategic Priority No. 7 team's ideas to position Sandia for the future. For questions or comments, contact team lead Tracy Wilbur. 

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# With grit and determination

Army veteran fights struggles, earns career through Sandia Exceptional Warrior Program



**PUSHING FORWARD** — Mechanical engineer and Army veteran Mark Small started as an intern at Sandia and has since earned two degrees and a staff position. He now recruits veterans to the Labs through the Exceptional Warrior Career Development Program. **Photo by Rebecca Gustaf**

By **Manette Newbold Fisher**

Sandia mechanical engineer Mark Small was good at being a soldier.

He learned to lead and developed strong relationships with those he served within the Army's 82nd Airborne Division. In 2008, he was deployed to Iraq where he directed combat missions before returning home in 2009.

"I got back from Iraq and I thought I was 6-foot-tall and bulletproof, but when you're still in the service, ... you're always busy," he said. "Your mind never has time to stop and think about what has gone on in your life so when I got back, when I got out of the military, I got to New Mexico and everything slowed down a lot, and a lot of veterans struggle with that."

Mark said he experienced multiple improvised explosive device detonations and grenade attacks in Iraq, but while he was deployed, he didn't have time to fully process what had happened. In 2011, when he separated from the Army, those experiences were more difficult to deal with away from the Army and people who understand the military and war the way he does.

"You don't have your brothers or sisters to the left or right of you to push you forward and keep going," he said. "I didn't have that when I got out, and it was hard because I felt alone."

Mark said he fell into depression and started having problems in school and relationships. When he sought help, he was diagnosed with post-traumatic stress disorder. Mark's path toward rehabilitation took many steps, including counseling and working with Veterans Affairs on a path forward. A large part of that journey was finding a Sandia program that helped him move toward his goals, he said.

Mark started working at Sandia as an intern through the former Wounded Warrior Career Development Program, now called the Exceptional Warrior Career Development Program. He was assigned mentors who had also served in the military, and he learned from technical staff mentors and managers who oversaw his progress. Mark also committed to attend college and eventually earned bachelor's and master's degrees from the University of New Mexico and secured a staff position at the Labs. He is one of the program's success stories, and he now works to recruit other veterans to Sandia.

"I love working at Sandia because I'm still able to contribute my service to my country," Mark said. "I love the work that we do. It makes a special connection with me because I know how it is

for our warfighters down range, and the technology that we are developing really helps every single little bit that we can."

## From 'Wounded' to 'Exceptional'

Certain stigmas come with being labeled "wounded," which is one of the reasons Sandia's program name changed.

"Words mean things," said Sandia veteran recruiting specialist Tony Lona. "We want our veterans to know that their wounds don't have to define everything about the rest of their lives."

Tony served as a Marine in Iraq and Afghanistan and was injured by back-to-back improvised explosive devices. He said he knows what it's like to come home and wonder what to do next.

"When you're in rehab, you realize some things will never be the same," Tony said. "Especially if you're married or have kids, this can cause concern. When you're going through rehab, you ask yourself if you can still do what you used to do."

Tony is working to steer Sandia's Exceptional Warrior Program away from using words like disability and disorder, and instead replace them with words that focus on the progress veterans make following military service and combat injuries. For example, he said, rather than focusing on PTSD, he tries to focus on what happens after the diagnosis.

"People call it post-traumatic stress disorder. We're all familiar with it, but we're trying to turn the page on that, and we're trying to focus on PTG, which is post-traumatic growth," Tony said. "That's a clear definition of where Mark is. He had the chance and opportunity to feel sorry for the rest of his life, but Mark took a look at himself and said, 'Hell no, this is not going to define me.' That applies to anybody. You fight through that and work yourself through that."

While Mark can talk about having PTSD, and he says there's not a cure, it's not something he fully identifies with.

"I hate the term PTSD. It gives veterans a bad rep, I guess," he said. "Even to this day, I don't think that something's wrong with me, or anything like that. I had events that happened in my life that changed me. Every person out there has had things that have happened to them in their life, and they have to live with that and move forward. It's about how you move forward and what you do for the rest of your life."

## Military leadership skills translate to Labs work

The federal veteran hiring benchmark in fiscal year 2019 was 5.9%, Tony said, and Sandia was well above the benchmark: 10% of all new hires

were veterans. Tony and Mark talk to veterans about working at Sandia through recruiting initiatives such as the Exceptional Warrior Career Development Program. Mark said while many veterans don't have degrees for a variety of reasons, they have the potential to use skills they learned in the military outside of school.

"And a lot of the stuff that I do on a day-to-day basis is not what I learned in engineering school, but it's stuff I learned back in the military," Mark said. "I was working on a Sandia project recently, and I was leading a 6-7 man team, and afterwards one of the leads told me, 'Those were some excellent leadership skills.' And I'm like, 'Well, I could lead combat patrols in Baghdad so, you know, I think I got this under control.'"

Mark said military personnel work on solving tough problems, which is a skill that can be used at Sandia every day. He also highlighted the support system Sandia provides, including managers and mentors who are there to help.

Outside of Sandia, Mark is working on building a ranch in the mountains, and he recently became a father. In the future, he envisions himself working at the Labs and connecting with other veterans who struggle, and he hopes to show them what they can do.

"We all go through struggles, and I still struggle a lot in my life, but seeing where I was and how far I've made it, I just keep going forward, and I'm hoping to inspire veterans out there to go down the same path that I went down or go down their own path and do great things for themselves and for their country," he said. "I think with hard work and determination and the right people around you, you can achieve anything." 

## Exceptional Warriors

Learn more about the Exceptional Warrior Career Development Program on Sandia's external website, [sandia.gov](http://sandia.gov) (see Careers, Special Programs). The program provides employment that supports national security missions while helping participants pursue college education and acquire career skills through training and mentoring.

Veterans who apply to the program must provide a resume and participate in a screening call where they can share their military history and explain why they are qualified. The program currently supports 40 veterans.



W.C. Kruger and Associates designed the original set of permanent buildings in TA-I.

Photo courtesy of Sandia National Laboratories

# Building Sandia

## Historic architecture paves the way for Labs' mission work

By **Karli Massey and Jennifer Sawayda**

*The buildings and structures at Sandia reflect a rich and varied 70-year architectural history. This is the first in a series of articles that will explore the built environment of the Labs and the people who laid its foundation.*

Sandia's Albuquerque campus first began to take shape in the fall of 1945, when the Los Alamos based Z Division started moving down to the site. The first facilities reflected Z Division's purpose: field testing and weapon assembly operations. It was strategically positioned near the Kirtland airfield on Sandia Base (later merged into Kirtland Air Force Base).

To house Z-Division activities, several buildings were brought from other military installations. Building 828, an environmental test facility, was one of the first buildings specifically built for Z Division. A construction program focused on more permanent buildings began in 1947.

Sandia's built environment tells a story of its adaptation and vision for the future. "Architecture is both a snapshot in time that echoes what was happening in that era, as well as a reflection of the culture of the residents or workforce continuously through time," said Sandia architect Jim Oswald.

Jim not only looks at Sandia's buildings from his professional lens as an architect and strategic site planner, but also from a standpoint of pride and sentiment. "Many of the permanent structures in Tech Area I were designed by W.C. Kruger and Associates. My father was a draftsman for the firm and shared stories with me about his work at Sandia," he said. "I followed in his footsteps and performed work for many military sites, like he did for various Manhattan Project sites across New Mexico."

Willard Carl Kruger was a noted New Mexico architect and served as the state architect in 1936-37. During the New Deal, his firm worked on several Public Works Administration and Works Progress Administration projects. Many of his designs reflect the Spanish Pueblo Revival or Territorial Revival styles that are distinctly associated with New Mexico. Kruger designed the original set of permanent buildings in Sandia's Tech Area I.

"Kruger is a well-known and respected architect in New Mexico and played a large role in the 20th century architecture style in our state," Jim said. At Sandia, his projects illustrate a local, industrial reframing of the International and modernist styles that emphasizes the function of the building and incorporates flat lines and low profiles.

Another renowned local architect, Max Flatow, designed the Technical Library in the International Style. Completed in 1948, its modern functional emphasis is apparent in the flat roof, long horizontal bands of windows and lack of adornment.

"Lack of adornment in Sandia's International Style buildings is somewhat misleading," Jim said. "Look closely and you will notice small, charming details like the angled cast brickwork of Building 800's entry, the wrapped sandstone windowsills of neighboring (Building) 802, and the porthole light fixtures above the doors of (Building) 840."

Eight buildings make up what is referred to today as the brick district. "In the past two decades, as planners confronted the potential conflict between new facility needs to meet mission requirements and the constraints of the existing older buildings, they started to refer to districts within Tech Area I," said Sandia historian Rebecca Ullrich. "The brick district comprises the older Kruger and Flatow buildings that have been determined to be historic. Calling them out as an area helps preserve and maintain key features," she said. Today, there are also computing and manufacturing districts with distinct styles.

Kruger also had influence in Tech Area II's architecture with the design of the original weapons assembly buildings and the linear movement of items through a series of rooms in the assembly process. The two buildings were mirrors of each other.

"While demolished in 1998 because of maintenance challenges, these buildings represented the early evolution of the concept of using a series of bays in weapons assembly, as would be done in Kruger's designs at the Pantex Plant in Texas soon after," Rebecca said.

In 1956, Sandia officially established a second laboratory in Livermore, California, across the street from the University of California Radiation Laboratory. The six original buildings on campus (C911-C916) were built concurrently. All reflected a mid-century design philosophy with clean lines and long bands of windows, like the

early Albuquerque site facilities, but with a lighter feeling in color and weight.

Construction in Albuquerque was the heaviest in the 1940s and '50s. Sandia was expanding rapidly in the early Cold War push for a larger stockpile, and facilities in Tech Area I were multiplying. As environmental testing surged in the early 1950s, Tech Area III opened with the construction of the sled track, drop tower and centrifuge test facilities.

### Planning for the future

Of the 256 structures built before 1960, 144 are still standing; many are eligible for the National Register of Historic Places. "With that designation," Rebecca said, "making modern-day modifications and planning for the future always includes careful consideration of the historic status of these buildings."

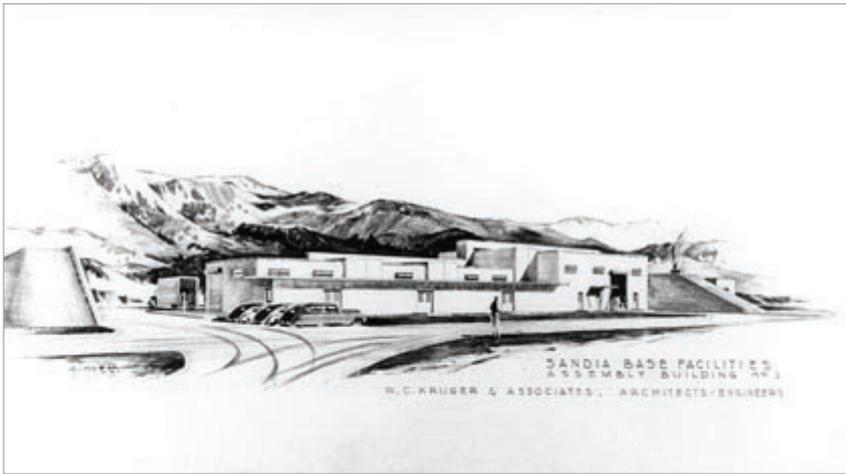
Facilities manager Matthew Brito served as site architect from 2000-2013 and helped establish the districts from a design perspective.

"When needing to make changes to one of these historic buildings for accessibility or operational efficiencies, we wanted to be sure to honor those historic design components," Matthew said.

Examples include the addition of the Glass Development Lab (Building 864) entry, which was required to improve physical security and resolve leaks, and the access ramps and elevator bank added to the east end of the Environmental Test Lab (Building 860). "In the elevator entrance, we kept the brick exposed as a peek back to history," Matthew said. "Also, to maintain the look and feel of the historic buildings, we developed a color pallet with rust and gold hues that we reference when designing new buildings or making updates and renovations."

Planning for the future of any site or campus has its challenges, but Sandia must also be a responsible steward of its funding when modifying older buildings and conceptualizing new structures. Jim is a member of the team that developed the 2040 Infrastructure Investment Strategy, which identifies facility needs for the next 20 years and beyond.

"Detailed analyses of our needs are foundational to our work," he said. "What makes working at Sandia enjoyable is the opportunity to walk in the presence of historic figures, while planning for technological advancements that we can't even fathom yet." 



W.C. Kruger and Associates designed Sandia's weapons assembly buildings. A W.C. Kruger architectural drawing, left, shows plans for Building 904. The photo on the right shows Building 907 shortly after it opened in 1948. **Images courtesy of Sandia National Laboratories**



Building 828 was one of the first buildings specifically built for the Z Division as an environmental test facility. The building, left, was demolished in 1999, and the 50th anniversary monument, right, was built in its place to honor Sandia's history. **Photos courtesy of Sandia National Laboratories**



Architect Jim Oschwald was awarded the 2019 President's Medal for Distinguished Service from the National Council of Architecture Registration Boards. His father was one of the original draftsmen working with W.C. Kruger and Associates. **Photo by Randy Montoya**



Building C913, a machine shop and assembly building, was one of the first permanent structures built at Sandia's California site. It has since been demolished. **Photo courtesy of Sandia National Laboratories**



Access ramps and an elevator bank were added to the east end of the Environmental Test Lab (Building 860) to comply with access requirements while preserving the historic design of the building. **Photo by Randy Montoya**



Max Flatow designed Building 804 in 1948. The flat roof and horizontal bands of windows reflect the modern functional design popular in architecture in that era. **Photo by Randy Montoya**

# Exceptional service in the national interest



Timeline shows key negotiations that launched Sandia Lab, marked beginning of Labs' 70-year history



November 1, 1949 — Building 800 was one of the first buildings constructed at Sandia Lab. See Building Sandia on pages 4-5.

By **Rebecca Ullrich and Meagan Brace**

Two dates are well known to Sandians: the day President Harry Truman wrote a letter calling for “exceptional service in the national interest” and the day Sandia (previously Z Division) separated from its parent, Los Alamos National Laboratory, and became the entity we know it as today.

During the six months from May 13 to Nov. 1, 1949, a fair amount of negotiation, hesitation and ambiguity ensued before the management reins of Sandia Laboratory were officially handed over. And in the seven decades that followed, the organization now known as Sandia National Laboratories has made a significant mark on our nation and the world.

## Negotiations set Sandia in motion

**May 10, 1949:** Sandia Laboratory was still a branch of Los Alamos Scientific Laboratory when U.S. Atomic Energy Commission Chair David Lilienthal recommended that American Telephone & Telegraph be asked to take on management of the Lab.

**May 13, 1949:** President Harry Truman wrote an iconic letter to AT&T President Leroy Wilson, informing him of AEC’s intent to ask Bell Telephone Laboratories to manage the Lab. Truman urged Wilson to undertake the task, indicating an opportunity to render “an exceptional service in the national interest,” which is the source of Sandia’s motto.

**May 30, 1949:** When AEC representatives Chairman David Lilienthal, Carroll Wilson and Division of Military Applications Director General James McCormack visited Leroy Wilson to discuss the contract, he expressed concerns about the then-pending antitrust suit against the Bell System; his preference for a no-profit, no-fee arrangement; and the defense workload to which AT&T was already committed. However, he agreed to consider their request.

**July 1, 1949:** Wilson formally accepted the contract to operate Sandia on behalf of the Bell System, comprising AT&T, Bell Laboratories and Western Electric. Because Sandia was an engineering lab, Western Electric — the engineering

arm of the Bell enterprise — undertook the management role.

**August 29, 1949:** On the same day that the USSR detonated its first nuclear device, Captain Carroll Tyler of the AEC, Robert Underhill of the University of California and Fred Lack of Western Electric gathered



**August 29, 1949** — Negotiations to turn management of Sandia Laboratory over to Western Electric included, from left, Bell Telephone Laboratories President M.J. Kelly, Sandia Corporation President George A. Landry, Bennett Boskey of the Atomic Energy Commission General Counsel’s Office in Washington, DC, Division of Military Application Director Gen. James McCormack, DMA Deputy Director Col. R.T. Coiner, Bell Telephone Laboratories Vice President Donald A. Quarles, Western Electric Company President Stanley Bracken, Sandia Laboratory Director (while under Los Alamos National Laboratory) Paul J. Larsen, Western Electric Company Vice President Fred Lack, Richard Smith of AEC Procurement New York Operations Office, and AEC Sandia Office Manager G.P. Kraker.

**May 13, 1949** — President Truman’s letter to AT&T President Leroy Wilson about Sandia inspired the Labs’ motto, “exceptional service in the national interest.”

in Los Alamos to draw up and sign the formal “Takeover Agreement” for Sandia Laboratory. Their goal was a smooth transition to industrial management with minimal disturbance to current operations. A month later, Western Electric executives signed the Certificate of Incorporation that created Sandia Corporation.

**October 6, 1949:** During the first Sandia Corporation Board of Directors meeting, the contract between AEC, Sandia Corporation and Western Electric was executed. The Certificate of Incorporation had been filed in Delaware the day before. The first board members were H.C. Beal (VP Manufacturing), Fred Lack (VP Radio Division), Walter L. Brown (VP and General Counsel) and George Landry, all from Western Electric.

**November 1, 1949:** Sandia became its own entity, and Sandia Corporation (a wholly owned subsidiary of Western Electric) took over management of the Lab for the AEC. George Landry served as the first president of Sandia Corporation and first director of Sandia Laboratory.

Sandia opened the Livermore, California, site in 1956, and Congress officially designated Sandia a DOE national laboratory in 1979. Sandia Corporation became a wholly owned subsidiary of Martin Marietta (later Lockheed Martin

THE WHITE HOUSE  
WASHINGTON

May 13, 1949

Dear Mr. Wilson:

I am informed that the Atomic Energy Commission intends to ask that the Bell Telephone Laboratories accept under contract the direction of the Sandia Laboratory at Albuquerque, New Mexico.

This operation, which is a vital segment of the atomic weapons program, is of extreme importance and urgency in the national defense, and should have the best possible technical direction.

I hope that after you have heard more in detail from the Atomic Energy Commission, your organization will find it possible to undertake this task. In my opinion you have here an opportunity to render an exceptional service in the national interest.

I am writing a similar note direct to Dr. O. E. Buckley.

Very sincerely yours,

Harry Truman



**October 6, 1949** — George Landry was the first Sandia Laboratory Director and President of Sandia Corporation.

Corporation) in 1993. Then, on May 1, 2017, National Technology and Engineering Solutions of Sandia LLC, a wholly owned subsidiary of Honeywell International Inc., assumed management of the Labs.

## Where we are now

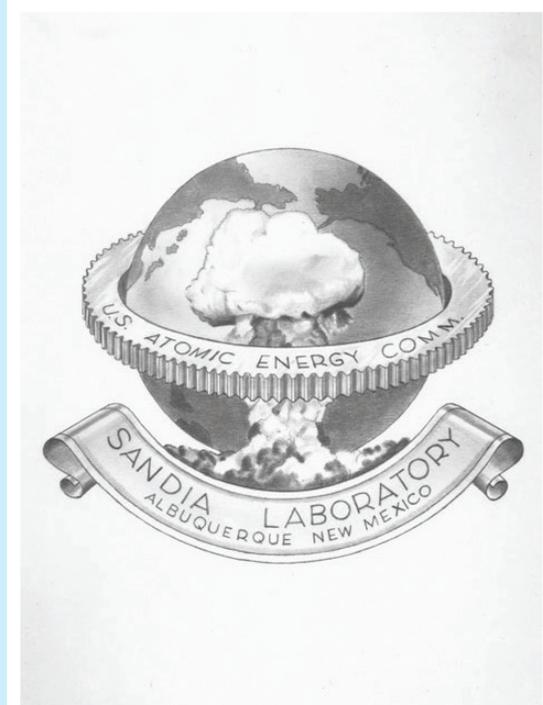
Since that autumn day 70 years ago, 15 directors have led Sandia from a single-mission organization responsible for engineering nonnuclear components of nuclear weapons to a multiprogram organization engaged in a broad spectrum of national security issues.

In 1949, Sandia started with 1,720 people occupying 151,000 square feet of space in Albuquerque. Today, the Labs employs 12,920 people working in 7,088,020 square feet of laboratories, offices and other work space spanning four states.

For a complete look back at Sandia’s 70-year history, from building a nuclear weapons stockpile to post-Cold War transitions to today’s emphasis on national security, visit Sandia’s history timeline on sandia.gov. Employees can also view 70 Years of Sandia: How We Got Here, a special 70th anniversary presentation on the history of Sandia, available on the internal digital streaming library. [T](#)



constructed on the new Sandia Albuquerque campus. The building still stands today. For more on the history of Sandia architecture,



May 10, 1949 — An early logo shows that Sandia Laboratory was part of the U.S. Atomic Energy Commission.

## Labs historian Rebecca Ullrich presents 70 years of Sandia

By **Tim Deshler**  
Photos by **Randy Montoya**

As part Sandia's 70th anniversary celebration, Labs employees were treated to an insightful, humorous and engaging presentation, "70 years of Sandia: How did we get here?" by Sandia historian Rebecca Ullrich. During the presentation, Rebecca described the Labs' path from its beginnings as part of Los Alamos National Laboratory to the launch of Sandia Corporation and the Albuquerque campus to the expansion of the Labs to its current state. Along the way, she explained how Sandia's initial nuclear weapons national security mission expanded to include research and development, and she highlighted the origins of Sandia's casual culture, can-do attitude and straightforward approach to interactions.

Rebecca described the sense of community that developed early at Sandia, noting that the remote location, the secret nature of the work and the number of employees who came from other places led employees and their families to develop a tight-knit community, living in base housing and enjoying the amenities of the Coronado Club.

That community feel was evident in the Lab News precursor, Sandia Lab Bulletin, which featured stories about employees' hobbies and adventures. The early Lab News continued that tradition, reporting on Sandia sports teams and events, hunting adventures, clubs and other recreational activities. Sandia's thunderbird logo was the winning entry in a logo design competition — the top choices were printed in the Lab News and employees voted on the winner.

Rebecca also talked about the history of women at the Labs, noting that very few women started working in technical jobs at Sandia early on, but that the Labs' focus on research and education opportunities helped female employees move beyond support roles to technical, scientific and leadership positions.

Wrapping up the talk with a brief Q&A, Rebecca was asked how the men who started Sandia Laboratory would feel about the Labs today. "When I look at Sandia, I can see the marks made by those in the 1940s and '50s," she said. "They would probably say we have a lot more processes governing how we work, but I think they would still see the lab they built in the lab we have now."

Employees who missed the presentation can view the video on Sandia's internal digital streaming library. [i](#)



**HOW DID WE GET HERE?** — Sandia historian Rebecca Ullrich presented an overview of Sandia's history during her talk at the Steve Schiff Auditorium as part of the Labs' 70th anniversary celebration.



**JOBS FOR WOMEN** — During her presentation for the 70th anniversary of Sandia, historian Rebecca Ullrich highlighted the contributions of women and their roles at the Labs, from support staff to research to leadership.



**HISTORY GOODIES** — Talk attendees visited information tables after the presentation to see historic brochures, photos and posters and enjoy sugar cookies featuring Sandia's 70th anniversary logo.

## 70 ways Sandia has changed the nation

Since 1949, Sandia has developed science-based technologies that support national security. Americans depend on Sandia's technology to solve national and global threats to peace and freedom.

Inventions like the clean room, polycrystalline diamond compact drill bits, percussion-actuated nonelectric disrupter and rapid medical diagnostic tools have revolutionized industries.

Our experts have been called to investigate and intervene following major accidents involving spacecraft, battleships, offshore drill rigs and nuclear power plants. Advances in nuclear deterrence, antiterrorism, supercomputing, hypersonics and pulsed power have changed the world for the better.

To commemorate the Labs' 70th anniversary, Sandia has created a website and brochure featuring these and other significant Labs contributions to national security. Pick up a brochure or visit [sandia.gov](http://sandia.gov) to learn more. [i](#)

# National Disability Employment Awareness Month

By **Victoria Newton**

Several Sandia events honored this year's National Disability Employment Awareness Month. The annual campaign, held each October and spearheaded by the Department of Labor's Office of Disability Employment Policy, raises awareness about disability employment issues and celebrates the many and varied contributions of America's workers with disabilities.

Sandia's Disability Awareness Committee and the Inclusion, Diversity, EEO & AA organization hosted a Diversity Cinema on "Invisible Identities," moderated by Esther Frederick, Victoria Newton and Venessa Martinez.

Using disability as the springboard, the group held conversations around the intersectionality of invisible identities. After watching Heather Evans' Ted Talk, "Uncovering: An Empowering Pathway to Disability Identity," the group explored how the environment creates disability, the impact of invisibility on the disability identity and what actions we can take to instill a diverse culture.

"Everyone is going through things that aren't apparent to the casual passerby, colleagues or potentially even to good friends: whether that be an invisible disability, a stigmatized minority



**INVISIBLE IDENTITIES** — From left, Esther Frederick, Venessa Martinez, Victoria Newton and American Sign Language interpreter Adam Romero presented at the October Diversity Cinema on Invisible Identities. **Photo by Lonnie Anderson**

identity or an experience or struggle we are going through that we haven't shared," Esther said. "Empathizing through the shared understanding of our own invisible experiences, even when we are not privy to someone's invisible identities or have not been through their specific experience, promotes an environment where diversity becomes the norm."

In another event, Jeralyn Kabigting started the conversation on anxiety by providing a TED-Talk-like presentation and leading a discussion on negative stigma, coping and reaching out for support.

"Anxiety impacts 30% of adults at some point in their lives, and it is of utmost importance for individuals to recognize they don't need to suffer in silence and that resources exist," Jeralyn said.

Disability Awareness Committee members participated in the National Labs Day at Rochester Institute

of Technology and the National Technical Institute for the Deaf Career Fair where they met with professors, deans and administrative leadership to cultivate a strong network within this talent channel.

"The team attended a meaningful briefing and initiated dialogue associated with best practices for hiring individuals with disabilities," said Tony Lona, Sandia's veteran and disability recruiter.

The team hosted a roadshow for staff and management to spread awareness around disability, diversity and inclusion through training and exercises designed to help people understand various perspectives. They also participated in Lawrence Livermore National Laboratory's Neurodiversity Celebration to begin discourse regarding hiring and providing support for neurodivergent individuals.

Employees can visit the Diversity Awareness Committee's internal website for additional resources and guidance on promoting diversity. 



**RECRUITING TALENT** — Signers, speakers and interpreters engaged with culturally deaf students at a career fair hosted by the Rochester Institute of Technology and the National Technical Institute for the Deaf.

**Photo by Victoria Newton**

## From Afghanistan to Alaska, with atmosphere in between

*Military service supports Sandia contractors working at remote research station in Alaska*

By **Melissae Fellet**

For Justin LaPierre, helping maintain an atmospheric research station at the northern tip of Alaska is "eerily reminiscent" of being deployed in the deserts of Afghanistan — just much colder.

A U.S. Marine Corps veteran, LaPierre has worked as an observer at Oliktok Point for two years. The site is the third mobile station of Sandia's Atmospheric Radiation Measurement research program, which has been monitoring atmospheric conditions and climate in the Arctic for more than 20 years.

For LaPierre and about half of his current and former colleagues at Oliktok Point, their experience in the military is similar to daily life in Alaska.

With a team of three others, LaPierre works a rotating three-week shift maintaining the research instruments, infrastructure and grounds of the research station. He compares the station to a forward operating base, an outpost remote from a main base that is fully supported by its own infrastructure. The mindset needed to work in Alaska is similar to that in a remote military outpost too, he said.

"I'm used to being away and doing the same thing day in and day out," he said. "Especially here in winter when there's a lot of snow shoveling to do, I know how to keep a positive mindset



**ARCTIC ATMOSPHERE** — Justin LaPierre and his colleagues work a rotating three-week shift maintaining the research instruments, infrastructure and grounds of Sandia's Oliktok Point research station.

**Photo courtesy of Sandia National Laboratories**

and keep moving forward to do the job at hand."

The observers work 12-hour shifts performing general operations, such as snow removal, monthly checks of the generators and maintenance of four microturbines that allow the site to generate its own power. LaPierre and his colleagues also walk through the site twice daily to make sure the scientific instruments are functioning properly.

The combination of hands-on work with the scientific focus at the Alaska site makes this job a perfect fit for LaPierre's background. Before his military service, LaPierre trained and worked as an electrician. In the Marine Corps, he worked in weather forecasting and data analysis. And after

discharge, he used the Post-9/11 GI Bill to complete his education in natural sciences.

"Observers like Justin are key to ensuring we continue to have high-quality information about conditions in the Arctic," said Fred Helsel, a Sandia engineer who manages the observers contracted to maintain the Oliktok Point site.

Data collected there by balloons floating through the atmosphere, radar monitoring clouds and instruments monitoring sunlight and snow complements information gathered at the program's long-term site in Utqiagvik, Alaska, the city formerly known as Barrow. The monitoring is sponsored by DOE's Office of Science, Biological and Environmental Research division. 

## Labs director updates New Mexico state legislators on Sandia successes, future

By **Manette Newbold Fisher**  
Photos by **Randy Montoya**

**S**andia Labs Director Steve Younger addressed the New Mexico State Legislature's interim Science, Technology and Telecommunications Committee last month, highlighting the Labs' accomplishments and commitment to the state.

Committee members and speakers focused heavily on job creation, the economy and the challenge to create and keep a strong STEM workforce in New Mexico. Rep. Melanie Stansbury, D-Bernalillo, asked Steve for help from the Labs.

"I really, strongly feel that the Labs could play a stronger role in helping to bring a more systemic approach to how our state addresses these issues," Stansbury said, emphasizing STEM and career pipeline issues. "I often say one of New Mexico's best exports besides green chile is our people. We export our people, and there are a lot of scientists and engineers who actually leave this state and then can't find jobs when they come home. How can we do a better job to make sure that our own smart people stay here as well, and get back into these jobs?"

Steve outlined how the Labs currently helps the state, and shared ideas that have been proposed to DOE. He also said state issues are wider than job creation, noting that family stability is something the state needs to work on so kids have better opportunities in school.

"I love New Mexico," he said, "but we're a poor state and we need some help. We need the Department of Energy to allow us to use some of our resources to help our state and help the city of Albuquerque deal with some of the problems, because we just can't do it on our own."

Steve said a limited number of community service hours are covered by federal funds, and if that number were expanded, it would be good for New Mexico.

### State spending, small business programs

At the time of the meeting, Sandia's projected budget for fiscal year 2019 was \$3.75 billion, a jump from the previous year's \$3.3 billion budget, Steve said. In fiscal year 2018, Sandia spent \$475 million in New Mexico on subcontracts, procurement purchases and with small businesses, and \$1.16 billion on labor in the state.

Regarding technology transfer and work with small businesses, Steve highlighted the Labs' 187 projects with small business through the New Mexico Small Business Assistance Program. Three new companies joined the Sandia Science & Technology Park in 2019, and six employees took leave from Sandia to start businesses through the Entrepreneurial Separation to Transfer Technology program.

Steve also emphasized recently developed initiatives over the past few years, including the C3



**PUBLIC HEARING** — From left, Sandia Labs Director Steve Younger and Sandia government relations analyst Valerie Salim-Meza greeted Sen. Michael Padilla, D-Bernalillo, and interim Science, Technology and Telecommunications Committee Chairwoman Rep. Debra Sariñana, D-Bernalillo, ahead of a public hearing in October.

downtown space at the Lobo Rainforest building that has hosted more than 4,000 Sandia employees and community members since it opened in 2017. Supplier Open Houses connected 431 companies with Sandia employees in fiscal year 2019, and a DOE mentor protégé program to help small businesses compete for federal and industry opportunities launched in October.

Steve briefly explained the Labs' pension and 401(k) programs following a question from Sen. Nancy Rodriguez, D-Santa Fe. He said Sandia is evaluating current programs and may propose a hybrid program to DOE.

"I think this is important in several ways. First of all, people are not saving enough for retirement, so having that kind of benefit program is important," he said. "It also puts the national laboratories in a special position and keeps us in a more desirable position to offer a preferable retirement package."

Leaders are carefully looking at Sandia's overall benefit package, he said. "We should be the most attractive employer for bright scientists and engineers."

### Strengthening Sandia's future

Sandia leadership is looking toward the next 20 to 30 years, trying to predict the world's problems and Sandia's role, Steve said.

"Some of these problems are just crazy hard in terms of, how do you anticipate future threats?" he said. "There are two ways you can deal with national security threats. You can either anticipate a threat, or deal with it after it's anticipated you."

The Labs' nuclear weapons program is currently busier than it has been in 30 years, Steve said, and Sandia is "exceptionally popular right now" with the Navy, Air Force, Missile Defense Agency and Army, due to the Labs' hypersonics program.

Diversity in the workplace will also remain one

of the Labs' top priorities, Steve said.

"In my opinion, the worst thing you can do in thinking about the future of national security is to get a group of people who look just like me to say, 'Oh, here's what the future of geopolitics is and here's what we ought to be focusing on.' No," he said. "We need the broadest set of perspectives that we can get."

Steve's address was part of a public hearing that took place Oct. 7, at the New Mexico School for the Blind and Visually Impaired, located in the Sandia Science & Technology Park.

Other public hearing speakers included Patricia Beecher, superintendent of the New Mexico School for the Blind and Visually Impaired; Stuart Rose, founder of the BioScience Center; Matthew Ennis, chief executive officer of NTxBio, LLC; Murat Okandan, founder and chief technology officer of mPower Technology, Inc.; Jackie Kerby Moore, Sandia technology and economic development manager; and Mariann Johnston, Los Alamos National Laboratory technology engagement and entrepreneurship team lead. [f](#)



**LABS UPDATE** — Sandia Labs Director Steve Younger spoke to the New Mexico State Legislature's interim Science, Technology and Telecommunications Committee during a public hearing in October.

## ARIAA

CONTINUED FROM PAGE 1

"We welcome the center's announcement," said AITO senior adviser Dan Wilmot. "Partnerships between academia and DOE's national labs will be essential to our success in realizing the unlimited potential of AI to advance our core missions."

### Sandia's computing history

Sandia, one-third of the research triad, has a background in high-performance computing. Its researchers created the first parallel processing supercomputer, the Paragon; the first teraflop computer, ASCI Red; and the supercomputer Red Storm used by the U.S. military to shoot down an errant satellite traveling at 17,000 miles per hour, which was described as "hitting a bullet with a bullet."

The Astra supercomputer recently installed at Sandia is the first and fastest supercomputer to use Arm-based processors, thus widening the supplier field for supercomputer components. Arm processors previously had been used exclusively

for low-power mobile computers, including cell phones and tablets.

Now, as part of the ARIAA center, Sandia will develop methods to use emerging machine-learning devices effectively and provide AI researchers with access to computer facilities and testbeds.

"Sandia is extremely well-positioned to address the challenges in the co-design of AI/machine-learning accelerators for DOE's broad set of applications," said Jim Stewart, senior manager and Sandia's point of contact with DOE's Advanced Scientific Computing Research. "We're excited to be partnering with PNNL and Georgia Tech in this new multi-year effort that will enable AI and machine learning for science and engineering at unprecedented scales."

A focus of the center will be sparse computations, a type of computation that uses the principle that in real life there might be many interactions, but only a few that may affect the outcome to a problem. For example, there might be millions or even billions of users on a social media site, but a user cares about updates only from a few hundred friends.

"Sparse computations will be a focus of the ARIAA center because the method greatly reduces the number of computations on problems with large amounts of data," Siva said. "It is highly desirable to several computational areas of interest to DOE."

### Other contributors

PNNL, the lead lab, with its principal investigator Roberto Gioiosa, has expertise in simulations related to power grids, chemistry and cybersecurity. The lab has a history of research in computer architecture and programming models and owns a variety of computing resources, including systems for testing emerging architectures.

Georgia Tech, with its principal investigator Tushar Krishna, has experience in developing custom hardware accelerators for machine learning. The institution will focus on using this hardware for sparse linear algebra.

"The foundation of the partnerships reflected in this center were made possible by the strategic collaboration between Sandia and Georgia Tech over the past few years," Siva said. [f](#)

## Stephanie Hansen elected APS Fellow



**TECHNICAL EXCELLENCE** — Sandia scientist Stephanie Hansen has been elected Fellow of the American Physical Society by its Division of Plasma Physics.

Photo by Randy Montoya

By Neal Singer

Stephanie Hansen has been elected Fellow of the American Physical Society by its Division of Plasma Physics.

Stephanie studies the behavior of atoms in plasmas relevant to astrophysics and fusion science. She was recognized for contributions to the fundamental modeling of nonequilibrium atoms and radiation in extreme environments, and for using spectroscopic analysis to increase understanding of diverse laboratory and astrophysical plasmas.

“This honor is absolutely a credit to the encouraging environment and technical excellence of the Labs,” Stephanie said.

A Distinguished Member of the Technical Staff at Sandia, Stephanie is author or co-author on more than 150 scientific papers, has been awarded the Presidential Early Career Award for Scientists and Engineers, and is the recipient of a DOE Early Career award. She is also the chair of the APS-DPP committee Women in Plasma Physics, which works to address challenges for women in a field where they make up less than 10% of the workforce.

Fellowship signifies recognition by one's professional peers to members who make advances in physics through original research and publication, or significant innovative contributions in the application of physics to science and technology.

The fellowship was awarded at the APS-DPP yearly meeting in Ft. Lauderdale, Florida, at the end of October.

## John Shadid awarded Hughes Medal from USACM

By Neal Singer

Sandia computational scientist John N. Shadid has been awarded the Thomas J.R. Hughes Medal from the United States Association for Computational Mechanics.

The medal is given “in recognition of outstanding and sustained contributions to the broad field of Computational Fluid Dynamics that significantly advance the understanding of theories and methods impacting CFD.”

John, with a master's degree in mathematics and a doctorate in mechanical engineering from the University of Minnesota, won “for outstanding and sustained contributions to large-scale parallel multiphysics computational-fluid-dynamics solution methods, high-performance computing algorithms/software and numerical methods for coupled nonlinear partial differential equations.”

Computational mechanics centers on the development and evaluation of detailed mathematical models that provide computational solutions for the deformation and flow of solids and fluids caused by a wide range of forces.

Workers in the field model slow events ranging from the flow and stresses in the earth's mantle and its tectonic plates to the bending of beams and the response of biological tissues under loads. They also have modelled fast phenomena such as the hypervelocity impact of solids and the propagation of shocks and waves in inertial confinement fusion systems.

The award was announced at the U.S. National Congress on Computational Mechanics in Austin, Texas, in late July.



**OUTSTANDING CONTRIBUTION** — Sandia computational scientist John N. Shadid has been awarded the Thomas J.R. Hughes Medal from the United States Association for Computational Mechanics.

Photo by Randy Montoya

## SANDIA CLASSIFIED ADS

**NOTE: Dec. 6 will be the final issue of the Lab News for 2019. The deadline to submit an ad for that issue is noon, Friday, Nov. 22. This deadline change applies to the Dec. 6 issue only. The submission deadline for the Nov. 22 edition is noon, Friday, Nov. 15.**

### AD SUBMISSION GUIDELINES

**AD SUBMISSION DEADLINE:** Friday noon before the week of publication unless changed by holiday.

Questions to Michelle Fleming at 505-844-4902.

Submit by one of the following methods:

- **EMAIL:** Michelle Fleming (classads@sandia.gov)
- **FAX:** 505-844-0645
- **MAIL:** MS1468 (Dept. 3651)

- **INTERNAL WEB:** Click on the News Tab at the top of the Techweb homepage. At the top of the NewsCenter page, click the "Submit a Classified Ad" button and complete the form.

Due to space constraints, ads will be printed on a first-come, first-served basis.

### MISCELLANEOUS

**YOUNG AT HEART DICKENS VILLAGE,** Nov. 8-9 & 15-16, concerts w/Bar-D Wranglers, 7 p.m. Fri., 2 p.m. Sat. Martin, 505-858-3009.

**ELECTRIC DRYER,** GE model #DWSR483EB-3WW, large capacity, white, excellent condition, \$100; dinette set, 7-pc., oak, oval table, cushioned chairs, \$200. Henderson, 505-980-3295.

**FLOOR LOOMS,** Allen, 30-in., portable, folding, 15 dent reed, very good condition, \$400; 36-in. locally built, 10 dent reed, \$500. Bonadore, 505-280-7781, leave message.

**BALLOON FIESTA POSTER,** 1979, numbered 129/2500, by John Martinez, framed, depicts ace aeronaut, \$500. O'Grady, 720-587-9857.

**STUDDER SNOW TIRES,** 275/55/R20, Extreme Avalanche by Hercules, brand new, used only 2 weeks, paid \$1,200 in Feb. 2019, asking \$900 OBO. Goodson, 505-407-1688.

**SAFE,** Amvault, TL-15 burglary-2 hr. fire, model CE-2518, inside 25"H x 18"W x 16"D, 1,150-lbs., retails \$3,860, asking \$1,200. Highland, 505-804-0200.

**RADIAL ARM SAW,** Craftsman, 10-in., w/laser track, brand new, still-in-box, paid \$650, asking \$450. Buck, 505-353-2667.

**MACBOOK AIR,** 2017, 13-in., 1.8 GHz Intel Core i5, 8 GB RAM, 250 GB, flash drive, OS 10.12.6, battery normal, \$550. Trujillo, 505-670-2764.

**PLUSH STUFFED TURKEY,** Gund, 8-1/2"H x 8"W, sitting position, great for Thanksgiving, like new, \$16. Wagner, 505-504-8783.

**EXERCISE BIKE,** training bike, Le Tour de France, Pro-Form TDF Pro 5.0, purchased in 2016, ridden minimally, \$800. Ballantine, 505-220-0687, marissadevan@gmail.com.

**TOURING SKIS,** Volkl Katana V-werks, 112mm underfoot, 184cm, used 2 seasons, \$1,000 OBO; Volkl Confession skis, 2018 pro model, 117mm underfoot, 193cm, used 2/3 of season, \$650 OBO. Chow, 505-270-6678.

**LARGE COIN COLLECTION,** US coins, very good & better, all types, \$1,000 OBO. Davison, sogwap@netzero.com.

**DINING ROOM TABLE,** w/4 chairs, \$100 OBO; queen-size bed, w/drawers for storage, \$100 OBO. Lynch, 505-350-1998.

**DRUM SET,** Ludwig, drums, cymbals, bells, \$300; bumper pool table, w/top either poker or flat top, \$80. Sweatt, 505-504-4028, ask for Bill.

### TRANSPORTATION

'19 **TOYOTA 4RUNNER,** Limited Nightshade Edition, 4x4, tow pkg., 3rd row seating, fully loaded, black, like new, 4.9K miles, \$45,000. Torres, 505-508-6795.

'05 **SUBARU OUTBACK** 2.5i, AWD, wagon, willow green, 65.7K miles, good condition, only one owner, \$6,500 OBO. Demny, 505-917-7554, ask for Pat.

'18 **HONDA RIDGELINE SPORT,** AWD, white, black interior, Tonneau cover, all season mats, gate lock, 28K miles, like new, \$28,250. Coconcelli, 505-362-9000.

'13 **FORD FOCUS SE COUPE,** single owner, 48K miles, great condition, \$8,000. Henke, 913-671-9291.

'14 **ACCORD SPORT,** sedan, 6-spd. manual, 4-cyl., backup camera, spacious, clean, transferable warranty, 63K miles, \$13,000 OBO. LeJeunesse, lajeunesse.jeff@gmail.com.

'14 **FORD EDGE,** limited 4-dr., AT, 2WD, backup camera, pano-roof, power-lift gate, burgundy, 60K miles, very good condition, \$16,500. Graham, 505-293-7302.

'18 **CAMARO 2SS,** Redline edition, 6.1L, V8, 455-hp, black interior/exterior, 28K miles, \$36,000 OBO. Shaw, 505-379-9366.

### RECREATION

'06 **HARLEY-DAVIDSON FLHX STREET GLIDE,** Rinehart exhaust, Wheely Gee chrome, 18,886 original miles, \$8,500 OBO. Jojola, 505-554-0064.

'12 **KTM 350 EXC-F,** DMV road legal, \$5,500 OBO; '12 **Triumph 800 Tiger XC,** \$6,500 OBO; both clean, maintained, w/useful accessories. Seals, 505-263-2536, text or voice.

### WANTED

**SOMEONE TO ASSIST OLDER MAN,** w/household chores, no heavy cleaning, ~10 hrs./wk., \$15/hr., references required. Stone, 505-821-5070.

### LOST AND FOUND

**FOUND:** planner/calendar-style notebook, left in Center 6700 van. Nelson, marnels@sandia.gov.

## Mileposts



New Mexico photos by Michelle Fleming  
California photos by Randy Wong



Carol Bonney 35



Mark Savage 30



Bill Bohnhoff 25



Heather Christ 25



Karen Devine 25



Mendy Brown 15



Gina Tafoya 15

## Recent Retirees



New Mexico photos by Michelle Fleming  
California photos by Randy Wong



Wilbur Martin 43



Bruce Draper 41



Dean Mitchell 41



Tom Plut 40



Kevin Eklund 36



Dennis Lierz 34



Capt. Pablo Montoya 34



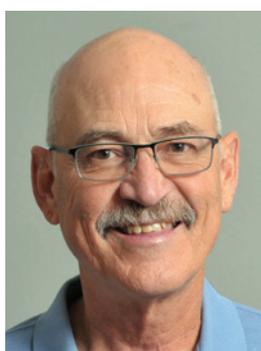
Mark Terhune 32



Robert Hillaire 29



Jennifer Plummer 27



John Burns 24

## Advanced microscopy

CONTINUED FROM PAGE 1

sequences of single-stranded DNA so that certain sections form base pairs with other sections. This forces the strand to bend and fold like origami. Researchers have used this principle to fold DNA into microscopic smiley faces, nanomachines with moving hinges and pistons and “smart” materials that spontaneously adjust to changes in the surrounding chemical environment.

“To build an airplane or a bridge, it’s important to know the structure, strength and stretchiness of every material that went into it,” said Adam Backer, a Sandia optical scientist and lead author of the study. “The same thing is true when designing nanostructures with DNA.”

While much is known about the mechanical properties of DNA’s double helix, mysteries remain about the details of its shape when the molecule is stretched in a laboratory to form the ladder-like structure of S-DNA. Standard ways of visualizing DNA structure cannot track structural changes while the molecule untwists.

### Manipulating microscopic particles

To characterize the structure and stretchiness of S-DNA, Adam worked with colleagues in the Physics of Living Systems research group at LaserLaB Amsterdam at Vrije University. Adam and his co-authors, Andreas Biebricher, Graeme King, Iddo Heller, Gijs Wuite and Erwin Peterman, described their process in the journal article.

Using instrumentation developed by his colleagues, Adam first attached a microscopic bead to each end of a short piece of viral DNA. These beads served as handles to manipulate a single molecule of DNA.

Next, the researchers trapped the beaded DNA in a narrow, fluid-filled chamber using two tightly focused laser beams. Because the beads stay trapped inside the laser beams, the researchers could move the beads in the chamber by redirecting the beams. This enabled them to stretch the attached DNA to form S-DNA.

This technique for manipulating microscopic particles, called optical tweezers, also provided precise control over the amount of stretching force applied to a single DNA molecule. However, the structural changes occurring within the stretched DNA molecule were too small to be directly observed with a standard optical microscope.

### Fluorescence polarization microscopy

To address this challenge, Adam helped his colleagues combine an imaging method called fluorescence polarization microscopy with the optical tweezers instrument. First, they added small, rod-like fluorescent dye molecules to the solution containing optically trapped DNA. In unstretched DNA, the dye molecules sandwich themselves between neighboring sets of base pairs and align perpendicular to the central axis of the double helix. If a stretching force causes the DNA base pairs to tilt, the dyes would also tilt.

Next, the researchers used the fluorescent signals from the dyes to determine whether the base pairs in stretched DNA tilted. The dyes emit green fluorescent light when they interact with light waves from a laser beam pointing along the same axis as the dye molecules.

The researchers changed the orientation of the light waves by rotating the polarization of a laser beam through various angles. Then they stretched the DNA and watched for green fluorescent signals to appear under the microscope. From these measurements, and computational analysis methods developed at Sandia, the researchers determined that the dyes, and thus the base pairs, aligned at a 54-degree angle relative to the DNA’s central axis.

“This experiment provides the most direct evidence to date supporting the hypothesis that S-DNA contains tilted base pairs,” Adam said. “To gain this fundamentally new understanding of DNA, it was necessary to combine a number of cutting-edge technologies and bring scientists from a range of different technical disciplines together to work toward a common goal.”

### Physical principles of DNA deformation

There is widespread speculation among scientists that structures resembling S-DNA may form during the daily activities of human cells, but at present, the biological purpose of S-DNA is still unknown. S-DNA might facilitate the repair of damaged or broken DNA, helping to guard against cell death and cancer. Adam hopes this clearer understanding of the physical principles governing DNA deformation will guide further research into the role of S-DNA in cells.

When Adam joined the Labs as a Truman Fellow in November 2016, he had the opportunity to start an independent research program of his own design. He had developed a method for polarization microscopy during graduate school at Stanford University and thought the technique had potential.

“At Sandia I wanted to push this technique as far as it could go,” he said. “The fact that this work has led to results with potential relevance to fields such as biology and nanotechnology has been extraordinary.”

# Using big data to solve big New Mexico problems

## NM Appleseed kicks off new season of Community Engagement Speakers Series

By **Stephanie Holinka**

Community Involvement kicked off this fiscal year's Community Engagement Speakers Series with a talk by NM Appleseed Executive Director and Founder Jennifer Ramo.

Ramo said NM Appleseed is a nonpartisan organization dedicated to ending poverty through systemic solutions to complex issues like hunger, education and homelessness. The organization seeks to be a bridge between policy and community reality, working toward data-informed systemic change that yields permanent or long-term improvement for the poor and underserved in New Mexico.

Anyone who follows news in New Mexico knows that most news about children in the state is not good.

"Basically we're the worst in everything," Ramo said. "The silver lining about being 50th in everything is that we can design and test poverty solutions that are scalable and replicable everywhere."

NM Appleseed is best known for writing the 2017 Hunger-Free Students' Bill of Rights, the first in the nation to prohibit lunch shaming of children whose parents owe school meal debt. The bill, signed by then New Mexico Governor Susana Martinez, arose from NM Appleseed's observations, over many years, of the shame and embarrassment faced by students denied a lunch because their families could not afford their cafeteria fees.

The organization also worked on the 2011 Breakfast After the Bell law, which requires all

high-poverty elementary schools to serve breakfast during the school day; the law has been replicated in more than a dozen states and districts. The organization also assisted with the 2015 Food Access Navigator project for the Navajo Nation and were awarded a USDA innovation demonstration grant.

### Poverty solutions need data

A barrier to solving poverty is the lack of data around the problem and little analysis of what efforts are effective. Ramo discussed her organization's work based on multisystem families research conducted by Robert Goerge at the University of Chicago.

An informal analysis identified about 16,000 families in New Mexico interfacing with public services like child welfare, mental health and substance abuse services, as well as adult and juvenile incarcerations. The state spent about \$56,000 per family on services, with no outcomes documented.

"The reality is that we don't really know what is working and what isn't," Ramo said.

That lack of granular data analysis means that the state spends money on programs and services based on "hunches."

"If poverty is this big and this expensive ... why aren't we using science to make things better?" she said.

Even before finding answers to complex questions, the lack of data analysis is so profound that the state doesn't know who needs services, no clearing house identifies what services an individual family is getting, and it's not clear whether the services families are getting are effective.

The NM Appleseed approach is to use scientific rigor to look at results rather than judging effectiveness based on how many people are

serviced. Along the way, the analysis could unearth unexpected opportunities to improve outcomes by focusing on specific populations and improvements, as it has when the method was deployed in other states. The organization's Family Success Lab has been working on this.

### Family Success Lab

The Family Success Lab pilot is a secure, integrated data bank that allows analysis to identify risk and protective factors that help predict and prevent problems, expand evidence-based programs and interventions to high-risk groups and evaluate programs, policies and interventions for effectiveness.

"If you talk to people doing this analysis, they are surprised by the findings from granular-level analysis," Roma said.

This type of analysis can identify ways to target policies to better identify groups needing services and clarify the types of services mostly likely to be effective.

People can help by donating funding to the program and to organizations that fight problems in the state. NM Appleseed does not take state dollars, and grant funding for this type of fundamental research is scarce.

"Everybody wants the fancy dishwasher (the randomized controlled trials), but nobody wants to put the plumbing in. New Mexico needs to put the plumbing in," Roma said.

Down the line, Roma and her team will be looking for help with data analytics. Those interested can contact NM Appleseed to volunteer.

Employees who missed Roma's presentation can watch the video on the internal Community Engagement Speaker Series SharePoint site. [@](#)



**ANALYSIS NEEDED** — "If poverty is this big and this expensive ... why aren't we using science to make things better?" NM Appleseed Executive Director and Founder Jennifer Ramo asked during her Community Engagement Speaker Series presentation at the Steve Schiff Auditorium in October.

Photo by Lonnie Anderson



**FAMILY SUCCESS MISSION** — NM Appleseed Executive Director and Founder Jennifer Ramo spoke to Sandia employees during Community Involvement's first fiscal year 2020 Community Engagement Speakers Series presentation.

Photo by Lonnie Anderson



**DATA DRIVES SOLUTIONS** — The Family Success Lab pilot is a secure, integrated data bank that allows analysis to identify risk and protective factors that help predict and prevent problems for New Mexico families.

Image courtesy of NM Appleseed