BRITTLE MATERIALS STUDY — Brenton Elisberg, left, and Ryan Jamison (both 1556) look through a piece of cracked laminate glass, an example of how brittle materials can fail. Brenton and Ryan are part of Sandia's Brittle Materials Assurance Prediction Program (BritMAPP), which is studying brittle materials in three ways: through stress and loading; fracture mechanics to see how cracks start and develop; and the relationship between material properties and structure. Read Sue Major Holmes' story about their work on **page 4.**

(Photo by Randy Montoya)

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Sandia LabNews

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Since 1949 — *Managed by Sandia Corporation for the National Nuclear Security Administration*

Two Sandia researchers receive Presidential Early Career awards

By Neal Singer and Michael Padilla

Sandia researchers Stephanie Hansen (1684) and Alan Kruizenga (8366) are among 102 scientists and engineers selected to receive the 2017 Presidential Early Career Award for Scientists and Engineers (PECASE).

The PECASE, established in 1996, is the highest honor bestowed by the US government on outstanding scientists and engineers in the early stages of their careers. The awards traditionally are conferred annually at the White House following recommendations from participating US agencies.

Stephanie studies the behavior of atoms in extreme environments and is working under a five-year Early Career Award granted by the DOE Office of Science in 2014. Her work contributes to the tools used to model and interpret data from high-energy-density experiments and astrophysical plasmas.

Says Stephanie, "I am deeply honored to receive this award and find it humbling to receive individual recognition for work that is inherently collective and collaborative."

Alan currently leads DOE-supported work investigating materials compatibility, materials selection, and efficiency-generating technology for solar power systems and advanced reactor concepts. His research provides fundamental understanding of corrosion mechanisms and associated pioneering data for design and implementation of molten salt and liquid metal-based materials in high-temperature solar thermal and nuclear reactor systems.

(Continued on page 4)

mPOWER licenses Sandia's "solar glitter" tech. **Page 8.**

DWIGHT SORIA marks 50+ years at Sandia. **Page 11.**

TOP TWEETS OF 2016

PAGES 6-7

That's that

The changeover to our new management team is now well underway; a Sandia team is working closely with representatives from National Technology and Engineering Solutions of Sandia LLC (NTESS) – the Honeywell-led compamny – to ensure a handoff as seamless as possible from Lockheed Martin management as quickly as it can be accomplished – potentially as early as May 1.

Specifics are still thin on the ground regarding NTESS's plans but some of the details are being filled in. Last week, NTESS posted on its website – ntess-llc.com – an org chart showing its management team, a collection of individuals long on experience in lab operations, science, engineering, and national security missions. Several have direct experience at our sister labs at Los Alamos and Lawrence Livermore and one – Dori Ellis – is a familiar face to many of us here. Dori is returning to head up the Sandia/California site; before her retirement she served, among many other notable roles, as director of the Labs' International Security Programs.

I was heartened last week to read NTESS's first official news release, which included this paragraph:

"Sandia is the finest engineering laboratory in the world. NTESS' goal is to bring best-in-class business and operations systems to Sandia to maximize the contribution of the laboratories to the nation and improve integration across the lab and the complex. NTESS is committed to workforce recruitment and retention; local small-business procurement; technology transfer; regional university partnerships; and Science, Technology, Engineering, and Math (STEM) education and charitable giving."

If I had to write a description of how I'd ideally like to describe Sandia, I couldn't do better.

* * *

The transition – or maybe I should capitalize it: The Transition – has been on everyone's minds for several weeks now. When coupled with changes coming down from Washington, which could have as big an impact on us as the changeover from Lockheed Martin to NTESS, we are living in "interesting times," which is something your enemies supposedly wish on you. But change is in the nature of things. As Greek philosopher Heraclitus observed around 500 B.C., "Change is the only constant in life." Pretty smart, those Greeks.

My guess, and it's only that, is that for most of us, our day-in, day-out work flow isn't going to change that much. We'll continue to place an emphasis on excellence in mission delivery; safety and security will be highly visible and integrated into everything we do; the Sandia values we've lived by will not change in principle. They're good values, values for success at work and in life. They'll continue to define who we are . . .

•We serve the nation •We team to deliver with excellence •We respect each other •We act with integrity •We live safe and healthy lives

As we say goodbye to Sandia Corp. and welcome NTESS into our lives, we'll be saying goodbye, too, to a Lockheed Martin personality who has become almost a friend to us. I'm speaking, of course, of Jason, the "star" of many of the Lockheed Martin training videos we've watched over the years. It was fun seeing Jason make the same mistakes year after year and to wait for the thousand-yard stare to spread over his agile face as he realized he'd just messed up big-time. Jason was a great role model for us: A well-meaning, capable individual, Jason was an Everyman figure. He sometimes didn't quite think things through and didn't always know the rules but he was never mean or petty and always tried to make things right in the end. He was maybe a bit hapless, but aren't we all, sometimes? So long Jason, and thanks for showing us what *not* to do!

* * *

We've all seen during the latest political season how powerful and influential a force social media can be. This year, in particular, tweets on the Twitter platform seemed to make news and drive public discussion almost every day.

We've heard the stories about how this or that celebrity or entertainer has been brought low by a hasty, ill-considered tweet or Facebook posting. There are certainly hazards to be aware of with any form of communication, but used the right way, social media is maybe the greatest broad-band message-sharing tool ever invented. And Sandia does social media the right way. The Labs has established a powerful presence on social media platforms. Under the guidance of Sandia social media coordinator Darrick Hurst, the Labs' efforts in the new medium have been recognized many times over the past two or three years as best-in-class among .gov social media programs. In early January Darrick used Twitter-supplied metrics to compile a list of the top Sandia tweets of 2016. Check them out on pages 6-7 and check out Sandia's Twitter account at https://twitter.com/SandiaLabs.

See you next time.

– Bill Murphy (MS 1468, 505-845-0845, wtmurph@sandia.gov)

Alex Brown elected ASME Fellow

By Neal Singer

Fellows of the American Society of Mechanical Engineers are only 3.1 percent of ASME's 107,895 members. Alexander Brown (1532) is now one of that elite group.

According to the organization's home page, "Fellow grade is the highest elected grade of membership within ASME, the attainment of which recognizes exceptional engineering achievements and contributions to the engineering profession."

ALEXANDER BROWN

Says Alex, "It is great to have this recognition after a long period of service to the ASME Heat Transfer Division."

Alex's citation reads in part that "he has served in leadership roles within the ASME Heat Transfer Division for six years and continues as an associate editor for the ASME *Journal of Thermal Science and Engineering Applications*. His … experimental and modeling technical contributions … include significant advancements in the areas of computational fire dynamics, code coupling, liquid dynamics, plume dispersion, pyrolysis, and thermochemical biomass fuels."

Alex received his PhD in mechanical engineering from the University of Colorado at Boulder in 2001. While in Boulder, he had student research appointments at the National Center for Atmospheric Research in the Applied Technologies Division and at the National Renewable Energy Laboratory in the National Bioenergy Center. Shortly after earning his doctorate, he accepted a staff position at Sandia in its Fire Science and Technology department in the Engineering Sciences Center.

Alex supports system qualification activities that make up a large part of the fire science activities in Dept. 1532. His improvements in code and model development, simulation analysis, and experimental testing allowed him to make significant contributions to fire phenomenology and basic energy technologies. His work also is credited with contributing to the executive launch approval for sending special nuclear material into space, assembled prior to the launch of the Mars Science Laboratory rover in 2011. He has participated for about 10 years as an expert reviewer for nuclear power plant fire assessments based on recurring contracts from the Nuclear Regulatory Commission. He continues research related to biomass thermochemical processing, mostly through New Mexico Small Business Assistance-funded projects.

Among his other novel contributions are experimental and modeling work on liquid drop impact and break-up. He has developed code methodologies that couple fluid and solid mechanics simulations to provide engineering predictions of impact and impulse-dispersed liquids.

He has published approximately 100 articles in peer-reviewed conference proceedings and journals. He also was cited for mentoring undergraduate and graduate students from the University of Florida, Georgia Tech, University of Michigan, Syracuse University, Texas A&M, Texas Tech, the US Military Academy, and more. He was cited for extensive work on technical reviews for scientific publications and for proposals.

Alex was presented the award at the 2016 International Mechanical Engineering Congress and Exposition meeting in November in Phoenix.

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A new dawn for AM

Symposium focuses on additive manufacturing's future

By Jules Bernstein

With some $20 million invested into more than 80 additive manufacturing (AM)-related research projects, Sandia's commitment to additive manufacturing is clear. The challenge going forward is to synthesize the lessons from these disparate projects to realize the potential of this technology.

"We have to work across programs, across disciplines, across sites, and line organizations," says Christian Mailhiot (8300), senior manager for chemistry, combustion, and materials. To this end, Sandia hosted its second annual additive manufacturing symposium at Sandia/California on Jan. 11. Around 100 people attended either in person or via teleconference to share progress toward integrating AM into Sandia's national security mission.

AM, commonly known as 3-D printing, is a promising alternative to standard manufacturing for two big reasons: time and money. The raw materials for an object are made while the object itself is being created. This dramatically shortens the design and manufacturing process, potentially resulting in huge cost savings. It also enables the design of objects that simply weren't possible through traditional manufacturing.

Because AM is still relatively new, the "process-properties-performance" relationship has not yet been established. That is, the relationship between how AM objects are made, the physical properties of the objects, and ultimately how they perform in various environments need to be better understood. The unknowns in this relationship are largely what has kept NNSA from accepting AM parts into the nuclear weapons stockpile.

LEE "MICKEY" CLEMONS (8137), right, explains features of the new Optomec LENS machine to Devon Powers (8541). LENS technology was developed at Sandia in the 1990s. (Photo by Dino Vournas)

as the powders used in the process.

In another presentation, Rick Kellogg (2616) made the case for the Smart Multi-Material AM project (SmartMAM), an advanced multi-material manufacturing capability. It could be used to build electromechanical and sensing capabilities into the same device right alongside with the device's structural materials.

"This could eventually enable the production of entire components in as little as one day with no hands-on assembly," he explained. "Developing this type of AM would provide an unprecedented foundry-like capability to additively manufacture components and packaging for weapons and other systems."

The latter half of the symposium featured a poster session on AM projects currently under way. One of several posters presented by Nick Leathe (2616) focused on the development of shock-absorbing structures. Materials can behave elastically like a rubber band or spring, where the material eventually returns to its original state. This team is trying to make metal behave elastically to increase the amount of shock it can absorb. The project, in partnership with University of Texas, Austin, is in its third year. In 2017, the team will build and test the models they've developed.

Weapons parts are by no means the only application for AM parts. Maher Salloum (8959) and David Robinson (8341) presented a poster on a project to model the flow of fluid undergoing a chemical reaction while moving through a solid object, like the function of a catalytic converter in a car. Special surfaces inside a catalytic converter transform a car's exhaust into more benign components, resulting in less offensive exhaust.

Maher and David's team is modeling fluids zigzagging through structures in three dimensions. If all parts of the flow structure are evenly utilized, the structure can be smaller. In the case of an engine, this translates into higher efficiency. This year, the team will be conducting flow tests on the objects they've designed.

Looking toward the future

Additive manufacturing is not new to Sandia. In fact, Sandia helped develop two additive manufacturing techniques in the 1990s. One of these 3-D processes is robocasting, which forces a ceramic slurry through a pressurized needle to create a part that is then hardened in a furnace. The other process is known as Laser Engineered Net Shaping (LENS), in which complex metal parts are printed from powders.

Last year, a new LENS machine was installed in the Combustion Research Facility at Sandia/California. Its location within the Livermore Valley Open Campus facilitates increased external collaboration with industry and research universities including UC Davis, Berkeley, and Irvine. Symposium attendees viewed the machine during a tour of AM facilities at Sandia/California, which included capabilities for 3-D printing of plastic parts.

"We wanted the symposium to be a networking and collaboration opportunity," says Jonathan. "It was successful in that respect, so expect another one next year."

Given Sandia's leadership around multi-materials as well as partnerships with numerous universities, the Kansas City National Security Campus, Los Alamos, Lawrence Livermore, and Oak Ridge national labs, a new day is indeed dawning for AM research at Sandia.

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CaliforniaNews

Glimpses into current projects

The first half of the symposium — organized by managers Jonathan Zimmerman (8367) and Deidre Hirschfeld (1832) — featured a series of talks on aspects of integrating AM into the NW mission. In his introductory remarks, Mark Smith (1801), deputy director of additive manufacturing, shared the progress made at the Laboratories with this relatively new technology. Mark emphasized recent advances in materials assurance, design, and analysis, and multi-material AM, the core themes around which most of the current research and design work is done.

Tom Reynolds (8248) discussed prototype AM parts being designed and built for potential use in the W80-4 Life Extension Program (LEP), which is refurbishing the W80 warhead with replacement components for aging technology. Philip New (425) spoke about the difficulty in qualifying AM parts and the need to certify the design of those parts. Other qualifying considerations include calibration data and firmware of AM machines, and qualifying the people operating the machines as well

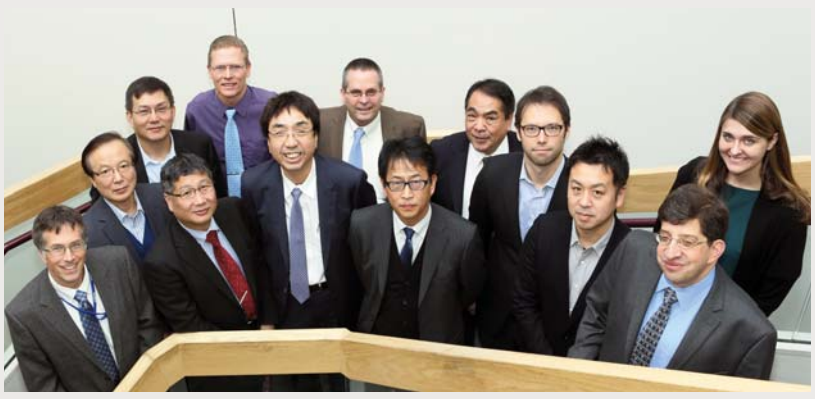
Dwight Soria marks 50 years at Livermore site
See page 11

Asian auto makers visit Sandia/California

HYUNDAI SENIOR VP Wootae Kim (left) chats with Research & Combustion Materials Center Manager Paul C. Miles (8362) ahead of the recent visit. (Photo by Dino Vournas)

Hyundai executives came to Sandia/California on Jan. 13 to learn more about the Laboratories' research on ways to increase engine efficiency. In addition to Hyundai Senior VP Wootae Kim (pictured above), company Director Heung Chul Kim, Senior Manager Chulho Yu, and Senior Research Engineer Hwang Bok Lee were in attendance. The presentation detailed Sandia's significant impact on automotive technology over the past 40 years, as well as information about current gasoline and diesel combustion research. Follow-up visits to the Hyundai R&D center in Korea are being planned to better define potential areas for future collaboration.

Senior Toyota officials visited Sandia/California Jan. 13 to explore collaborative opportunities in engine, hydrogen, and automobile battery technology. The day's agenda began with an overview of Sandia's transportation research, including work on improving fuel economy and alternative automobile power sources. Tours of the engine and hydrogen labs rounded out the visit. The visit reinforced a positive relationship with Toyota, with which Sandia has had a strategic partnership project on the impact of exhaust gas recirculation on engine knock for the past two years.



Left to right: Christopher Moen (8360); Tom Shieh, Toyota executive engineer; Toshiharu Noguchi, Toyota adviser; Carl "Magnus" Sjoberg (8362); Koichi Nakata (red tie), Toyota project general manager; Masanori Sugiyama, Toyota executive general manager; Paul Miles (light blue tie, 8362); Wataru Ozawa, Toyota senior vice president; Ben Wu (8610); Takumi Jinmon, Toyota manager; Hironobu Kogiso, Toyota adviser; Jonathan Zimmerman (8367); Leigh Anna Steele (2546). (Photo by Dino Vournas)

Understanding how brittle materials fail

By Sue Major Holmes

If you want to see what happens if your phone falls onto concrete, you could drop it — *or* let an engineer work out the consequences in advance.

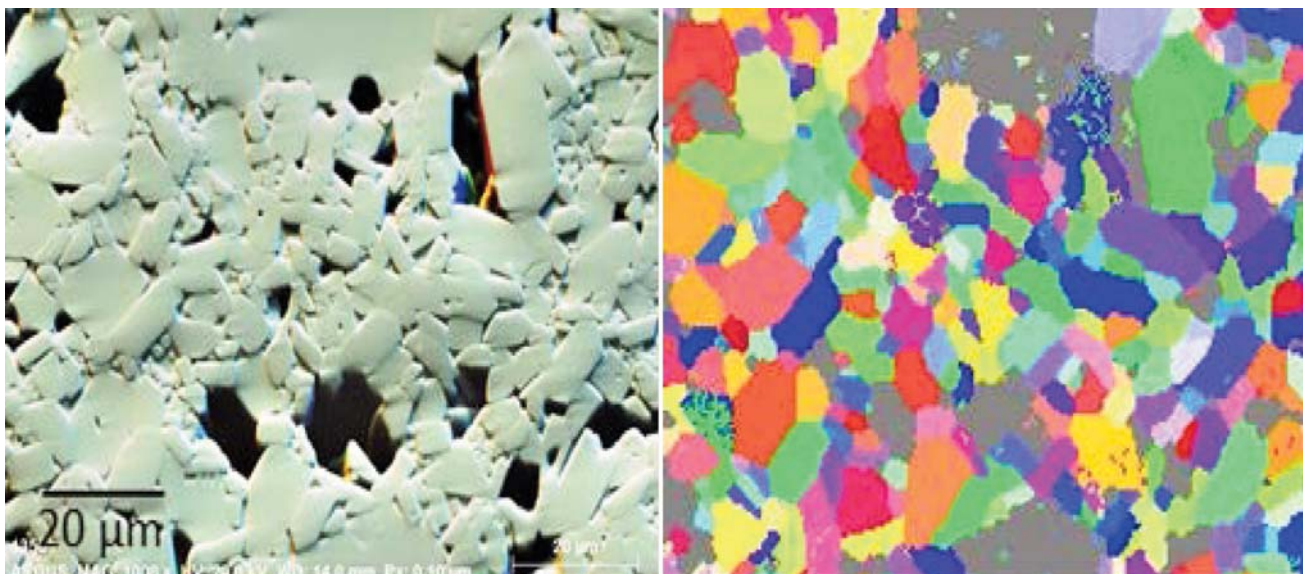
Odds are you'll go with the engineer.

Figuring out how brittle materials inside a device behave, and fail, is one goal of Sandia's Brittle Materials Assurance Prediction Program (BritMAPP). The program, which started two years ago and runs until 2020, studies brittle materials in three ways: stress and loading; fracture mechanics to see how cracks start and develop; and the relationship between material properties and structure.

Brittle materials such as glass fail suddenly and catastrophically. Unlike metals, which dent or bend if dropped, brittle materials just break. "You drop a hammer, and it might bend; you drop glass and it will shatter. It's done," says Ryan Jamison (1556), who works with Brenton Elisberg (1556) and other colleagues on the stress and loading part of the project.

They focus on how sudden failure affects the performance, reliability, and safety of components and systems where breaking has serious consequences, such as medical devices or satellites.

Stronger brittle materials that can handle the slings and arrows of everyday life will benefit all kinds of devices and ultimately, the people who use them. Someday, it might not be so worrisome when a cell phone falls onto a hard surface.



THIS ILLUSTRATION SHOWS THE MICROSTRUCTURE of a brittle material as seen through a Scanning Electron Microscope, left, and a graphic showing the grain orientation of that microstructure. It's part of research for Sandia National Laboratories' Brittle Materials Assurance Prediction Program (BritMAPP). (Image credit: Thomas Buchheit)

Ensuring functionality for 30 years

Sandia wants to develop the science, technology, and understanding to assure that brittle components in high-consequence systems remain fully functional over a 30-year lifespan. BritMAPP researchers are developing mechanics models and discovering fundamental property and structure relationships so they can shift from qualitative engineering judgment to quantitative predictions of brittle material failure and reliability.

Qualitative engineering judgments are decisions based on experience and comparing outcomes — A is better than B — while quantitative predictions are accurate based on the physical behavior of a material.

"We want to transition from making comparisons, 'A is better than B but we really don't know how good A is,' to making decisions based on measurable qualities, 'A is better than B because A will last for 10 years longer than B,'" Ryan says. "Being able to accurately quantify the difference is the key."

While he emphasized there's much work to be done, "we're already started well down that path."

Since it's not possible to test every possible scenario, researchers gather data for computer models through laboratory experiments, measuring materials properties to understand how things behave. Modelers make a computer representation of an object and then apply physical laws to predict how the materials behave mechanically: what happens when they're stretched or squeezed.

Understanding why it's failing

"This is where modeling is valuable," Ryan says. "We can make accurate predictions of things that we just can't get data for. It can help us understand why it's failing — not just that it's failing but what is causing the failure. We can examine things much differently than you can from a test, where you can't chop everything up to microscopic pieces and see how many parts you need to examine before you really understand."

Take a cell phone as an example. "Phones are made up of plastics and glass and other types of materials. Equations govern how these materials behave and we apply those equations to those materials in the form of a phone," Ryan says. "Then we apply different environments, such as dropping your phone. We simulate that in a computer, and through the equations that represent these materials we can determine if the glass or other component in the phone breaks."

Inferring the stress state

To give accurate quantitative answers, researchers must understand the stresses materials face. It's difficult to measure stress itself, so researchers measure the resulting strain or deformation. For example, they'll push a rigid tool into a brittle material and measure how cracks spread to infer the stress state.

They also measure materials properties. "Those are a little easier because you're measuring the direct response from a material due to a known load that's being applied," Brenton says. "Once we have material properties we have more confidence that our models are accurately predicting stress. The problem is that we still need to figure out what stress is required to break the material."

Thanks to more sophisticated modeling and ever-improving supercomputers, simulations have grown more complex, capturing materials behavior undetectable even a short time ago.

Still, extremely sophisticated models take time to run even with supercomputers. Last summer, Brenton ran a simulation for 72 hours on hundreds of processors, simulating a very long series of thermal test cycles. That would have been impossible two years ago due to inadequate computer processing power and models that weren't sophisticated enough to capture the physics that interest Sandia.

The team also is determining how much complexity is necessary.

"If component designers just want to know is Design A better than Design B, I can tell you that quickly," Brenton says. "If you want to know more specifically if and when Design A is going to fail, then that's when we run a more complex simulation that may run on a computer for days, but now we have the capability where we can predict or at least get a much better idea of when the design is near failure."

Validating lifetime predictions

Ryan and Brenton work with glass-to-metal seals, components vital to sending electrical signals through hermetically sealed systems. Glass-to-metal seals are ubiquitous in everything from medical devices to telecommunications that face high temperatures, pressure, or shock. They're also important in national security uses that have much tougher survivability and lifespan requirements, Brenton and Ryan say.

"The lifetime requirement is where we're trying to go with this Brittle Materials Assurance Prediction Program," Ryan says. "Right now we can make predictions of what would happen with these glass-to-metal seals and give qualitative guidance to designers and engineers. But we have that higher consequence application. We need to be able to say with some level of certainty that these components will last for 30 years, and have a materials and science explanation why."

The next step is experiments to validate the lifetime predictions. "We believe the behavior is being modeled accurately but it still needs to be validated in more complex applications," Brenton says.

"It's that marriage of experiments and modeling," Ryan says. "With discoveries that experimentalists have made, with advancements in the modeling that we've made, we can take that information the experimentalists are observing, put it in the models, and make more accurate predictions."

PECASE winners

(Continued from page 1)

"I am honored and thrilled to have won a PECASE award," says Alan. "I believe this validates the important work being done on energy efficiency at Sandia and in the nation. Providing long-lasting, efficient, and clean energy is one of the greatest challenges our generation faces."

Stephanie, at Sandia's main site in Albuquerque, is interested in how changes in the atomic-scale response of materials at extreme pressures and temperatures can affect the performance of high-energy-density experiments. One example is the Magnetized Liner Inertial Fusion (MagLIF) research currently underway on Sandia's Z machine. Under the force of Z's 20-mega-ampere currents, these experiments compress fusion fuel to gigabar pressures and heat it to 30 million degrees Kelvin — temperatures hotter than the sun.

STEPHANIE HANSEN

"Z offers an extraordinary platform for investigating atomic physics in extreme environments," says Stephanie. Combining her models with data collected on high-precision instruments developed and fielded by other Sandia scientists, she tries to find a consistent story about what happens on the nanosecond time scales of the Z experiments.

Experiments at other facilities also are of interest to Stephanie: In August 2016 she led an experiment to study the response of metal foils irradiated by the high-intensity X-ray laser at Stanford's Linear Coherent Light Source. "These are fascinating experiments because everything happens in less than a picosecond," she says. "The X-ray laser creates dramatic changes in the electronic structure before the ions even know what hit them."

At Sandia/California, Alan's primary area of research focuses on materials degradation and interfacial interactions in molten nitrate salt systems and liquid metal systems for thermal energy storage. Energy storage is a key challenge in providing cost-effective, on-demand power. Currently, power suppliers use batteries with lifespans that fall far short of the desired 30-plus year requirements for efficient, economical storage. Thermal energy storage captures energy in heat, which is then removed to generate electricity via steam or other working fluids, saving on cost and efficiency.

ALAN KRUIZENGA

To contribute to this vital systems work, Alan and his team ran a series of materials compatibility experiments with a variety of metal alloys to determine the best-suited containment material for molten nitrate salts in thermal energy storage systems. High-aluminum alloys, like those investigated by Alan, will be critical in reducing costs and ensuring long-term productivity by minimizing outages and down-time.

No date has been set for the award ceremony.

MORE THAN A PRETTY PICTURE — Tam Le, left, and Todd Noel use augmented reality head sets to help train physical security personnel from around the world. (Photo by Randy Montoya)

Augmented reality to enhance security

By Mollie Rappe

When you hear the term "serious gaming" you might envision professional eSports competitors gearing up for a League of Legends World Championship in front of tens of thousands of live fans and tens of millions of streaming fans.

At Sandia, serious gaming means something else entirely. Experts on physical security at the Labs apply the technology and methods of the game industry to real-world national security problems. Using pre-release stand-alone augmented reality headsets, computer scientist Tam Le (6835) and Todd Noel (6835) have adapted augmented reality to enhance physical security training and analysis.

"Physical security goes beyond guards, gates, and guns to include engineered solutions and complex systems that are designed to protect against the theft of nuclear materials and sabotage," says Dominic Martinez, manager of International Nuclear Security Engineering (INSE) Dept. 6835.

As part of Sandia's Center for Global Security and Cooperation, the goal of this department is to improve the security of vulnerable stockpiles of nuclear weapons and nuclear material worldwide. They are experts in physical security system design, installation, and analysis, and they assist with technical exchanges and applying nuclear security best practices. They provide their expertise to the International Atomic Energy Agency (IAEA) and NNSA's International Nuclear Security programs.

Educating others to secure nuclear materials

INSE has developed an extensive physical security training curriculum ranging from introductory classroom courses on the fundamentals of designing physical protection systems to more advanced training with hands-on field exercises conducting vulnerability assessments.

"It is important to educate others on how to properly secure nuclear materials around the world," says Dominic. "These professional development courses help minimize the learning curve and bring everyone up to international standards and best practices as fast as possible."

One of the workshops INSE teaches in collaboration with NNSA and IAEA is straightforwardly called the International Training Course (ITC). This three-week course has been conducted every year and a half for more than 35 years, with frequent revisions to reflect improving technologies and international best practices.

Seeing spatial relationships

ITC is an exercise-intensive course built around designing a physical protection system for a hypothetical nuclear power reactor or nuclear storage facility. Originally, the facility was presented as a floor plan on paper, but several years ago Tam created 3-D models of the hypothetical nuclear facilities to enhance the students' understanding of the layout. Tam says, "We model the mock facilities so the students can see the spatial relationships, see where things are in relation to each other. This helps them to understand a facility's vulnerabilities, which can be difficult to see on paper or in writing."

In addition to Tam's more classical simulations and visualizations for the ITC and other training courses, his recent work with augmented reality has the potential to revolutionize how the nuclear security engineering training team conducts workshops.

By combining augmented reality technology with Sandia's Integrated Security Facility (ISF), Tam says students can peer through walls to show all the processes needed to handle and protect nuclear material without using hazardous material. The ISF, located in Tech Area 5, utilizes the security systems originally designed to protect Category I nuclear material and now serves as a venue for hands-on physical security training. With its fully functional physical security and material accounting systems, Tam says, the facility is invaluable for demonstrating physical security and material control, as well as safety concepts and principles.

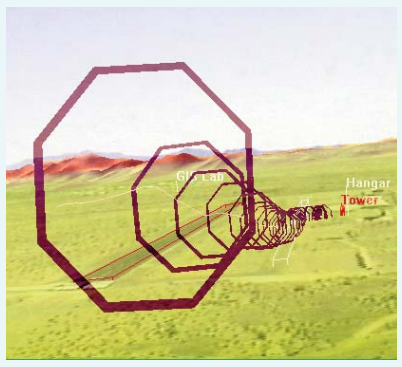
The same day the team received the augmented reality hardware, Todd created a camera placement tool that lets users add virtual sensors and cameras and then see what their fields of view would be in real time in the actual space.

The team uses the same software as small game development companies to develop many of their training and analysis tools without having to create everything from scratch. "We simply took the industry standard tools used for game development and applied them to our national security challenges," says Tam.

"With augmented reality we're able to do things that we wouldn't normally be able to do. We can show virtual characters handling material, putting it into the system, show how the material is taken out, the material flow, understand the vulnerabilities, and where materials can be lost. With this technology, we can actually show what is going on behind the walls," says Tam. "The application of these new holographic technologies will shape the future of our visualization, training, and analysis capabilities and is only limited by our creativity."

What is augmented reality

Augmented reality (AR) is a live direct or indirect view of a physical, real-world environment whose elements are augmented (or supplemented) by computer-generated sensory input such as sound, video, graphics or GPS data. . . . As a result, the technology functions by enhancing one's current perception of reality. . . . With the help of advanced AR technology (e.g. adding computer vision and object recognition) the information about the surrounding real world of the user becomes interactive and digitally manipulable. Information about the environment and its objects is overlaid on the real world. . . . The first functional AR systems that provided immersive mixed reality experiences for users were invented in the early 1990s, starting with the Virtual Fixtures system developed at the US Air Force's Armstrong Labs in 1992. — From Wikipedia



LANDFORM VIDEO MAP OVERLAY marking runways, road, and buildings during a 1999 flight test. (Image by Winged1der)

SANDIA SOCIAL MEDIA

#SANDIATOPTWEETS2016

Because Sandia's audiences, customers, and stakeholders — whether employees, potential employees, congressional members and their staff, agency officials, media, prospective partners, industry collaborators, or taxpayers in general — are using social media, it's important for Sandia to connect with them where they are. With direct channels for engaging with these audiences, social media complements traditional communications efforts and contribute to the Labs' broader business goals as a means to engage in conversations about our work, update followers about the latest Labs news, share employment opportunities, and support the open government principles of transparency, participation, and collaboration.

These tweets are a sampling of the content curated in keeping with that philosophy, and represents the posts those audiences engaged with the most on Sandia's Twitter account in 2016.

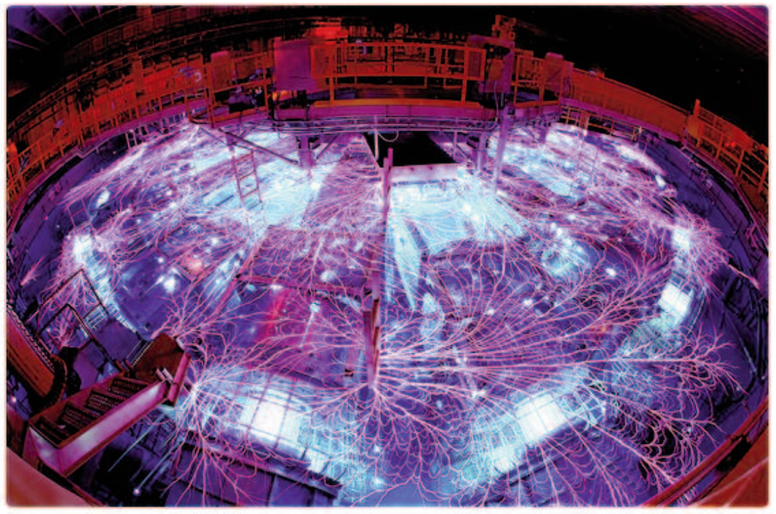
Join the conversation by following Sandia on social media:

- twitter.com/SandiaLabs
- facebook.com/SandiaLabs
- instagram.com/SandiaLabs
- youtube.com/SandiaLabs
- flickr.com/SandiaLabs
- plus.google.com/+SandiaGov/
- linkd.in/QldAO1

1

Sandia National Labs
@SandiaLabs

A supercharged Sandia Z machine could provide a path to sustainable #fusion #energy scim.ag/2fDQtuC via @sciencemagazine



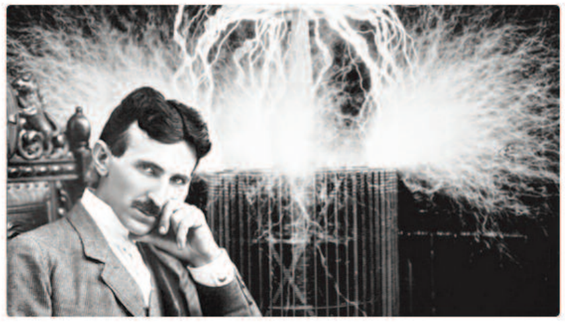
RETWEETS 65 LIKES 98

8:48 AM - 10 Nov 2016 from Albuquerque, NM

2

Sandia National Labs
@SandiaLabs

It's #NationalEngineersWeek! In celebration, here are a few signs you may be an #engineer: 1.usa.gov/1WDXuLh



RETWEETS 63 LIKES 61

11:21 AM - 22 Feb 2016

3

Sandia National Labs
@SandiaLabs

New design for giant #turbine blades can deliver low-cost 50-MW offshore #WindEnergy 1.usa.gov/1nlOeQh #energy

RETWEETS 65 LIKES 54

12:49 PM - 26 Jan 2016 from Albuquerque, NM

4

Sandia National Labs
@SandiaLabs

Betty Carrell, the first woman engineer at Sandia's CA site, began work in 1959. #WomenInSTEM #WomensHistoryMonth

RETWEETS 53 LIKES 62

5:01 PM - 3 Mar 2016

5

Fermilab @Fermilab 27 Apr 2016
What would you call our new baby bison? Tweet us with #BisonNaming. Please, no Bison McBisonface.

Sandia National Labs
@SandiaLabs

@Fermilab Neil deGrass Bison #BisonNaming

RETWEETS 23 LIKES 94

12:00 PM - 27 Apr 2016

6

Sandia National Labs
@SandiaLabs

#OnThisDay in 1945, the Atomic Age began at the Trinity Site with the 1st nuclear detonation bit.ly/29Xr8N5

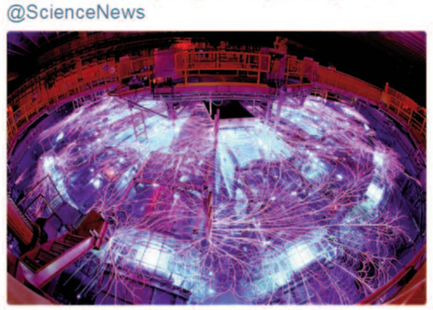
RETWEETS 45 LIKES 62

4:09 PM - 16 Jul 2016 from Albuquerque, NM

7

Sandia National Labs
@SandiaLabs

Chasing a devious metal: the pressure is on to make metallic #hydrogen bit.ly/2aOXgRs via @ScienceNews



RETWEETS 37 LIKES 50

10:43 AM - 11 Aug 2016 from Albuquerque, NM

8

Sandia National Labs
@SandiaLabs

Newly released Sandia study finds a high-speed, #hydrogen-fueled passenger ferry is feasible in #SanFranciscoBay bit.ly/2cUQo8W

RETWEETS 43 LIKES 38

10:11 AM - 6 Oct 2016 from Livermore, CA

9

Sandia National Labs
@SandiaLabs

In honor of #NationalHydrogenDay, here are 10 facts you may not have known about #hydrogen bzfd.it/2dCEXAL #FuelCellsNow #Science

RETWEETS 39 LIKES 27

4:16 PM - 8 Oct 2016

10

Sandia National Labs
@SandiaLabs

To develop advanced materials for renewable #hydrogen production, @ENERGY launches #NationalLabs HydroGEN consortium bit.ly/2f1N2Tm

RETWEETS 39 LIKES 45

4:27 PM - 24 Oct 2016

11

Sandia National Labs
@SandiaLabs

Happy birthday, @NASA! 🚀 Signed #OnThisDay, the Space Act created 58 yrs of out-of-this-world #science & exploration

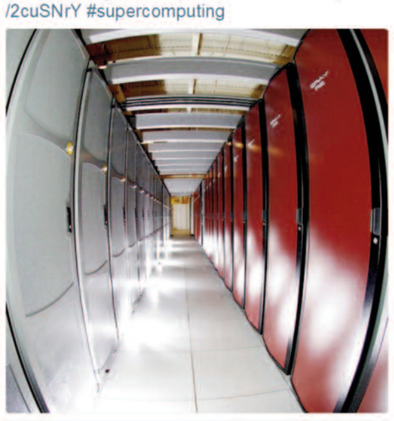
RETWEETS 34 LIKES 55

2:07 PM - 29 Jul 2016 from Albuquerque, NM

12

Sandia National Labs
@SandiaLabs

Sandia receives DOE funding to predict & modify next-gen materials with #HPC bit.ly/2cuSNrY #supercomputing



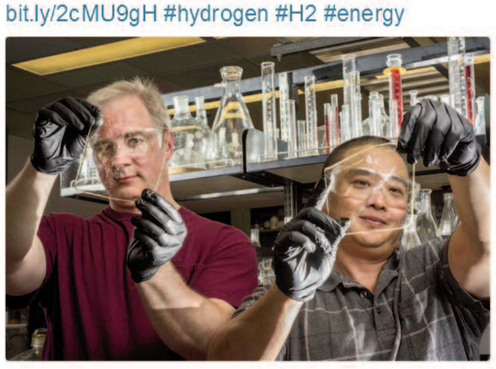
RETWEETS 26 LIKES 26

4:12 PM - 16 Sep 2016 from Albuquerque, NM

13

Sandia National Labs
@SandiaLabs

Sandia's new #FuelCell membrane outperforms the market's to provide power without pollution bit.ly/2cMU9gH #hydrogen #H2 #energy



RETWEETS 26 LIKES 28

10:36 AM - 3 Oct 2016 from Livermore, CA

14

Sandia National Labs
@SandiaLabs

Two Sandia inventions get an @ENERGY #TechTransfer funding boost to jump to the marketplace 1.usa.gov/28YJMjq

RETWEETS 24 LIKES 26

1:37 PM - 27 Jun 2016

15

Sandia National Labs
@SandiaLabs

The cleanroom was patented by a Sandia physicist #OnThisDay in 1964, making the modern #electronics age possible fal.cn/QyX4

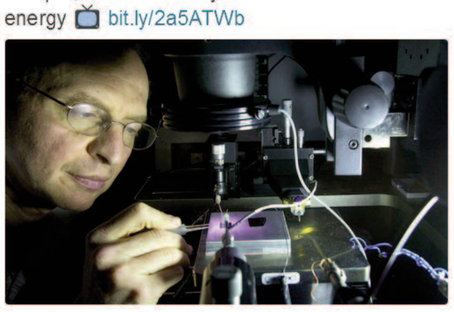
RETWEETS 23 LIKES 28

1:08 PM - 24 Nov 2016

16

Sandia National Labs
@SandiaLabs

A discovery by Sandia & @usnistgov means sharper, vivid color on your #TV with less energy 📺 bit.ly/2a5ATWb



RETWEETS 22 LIKES 22

5:37 PM - 27 Jul 2016

Home grown

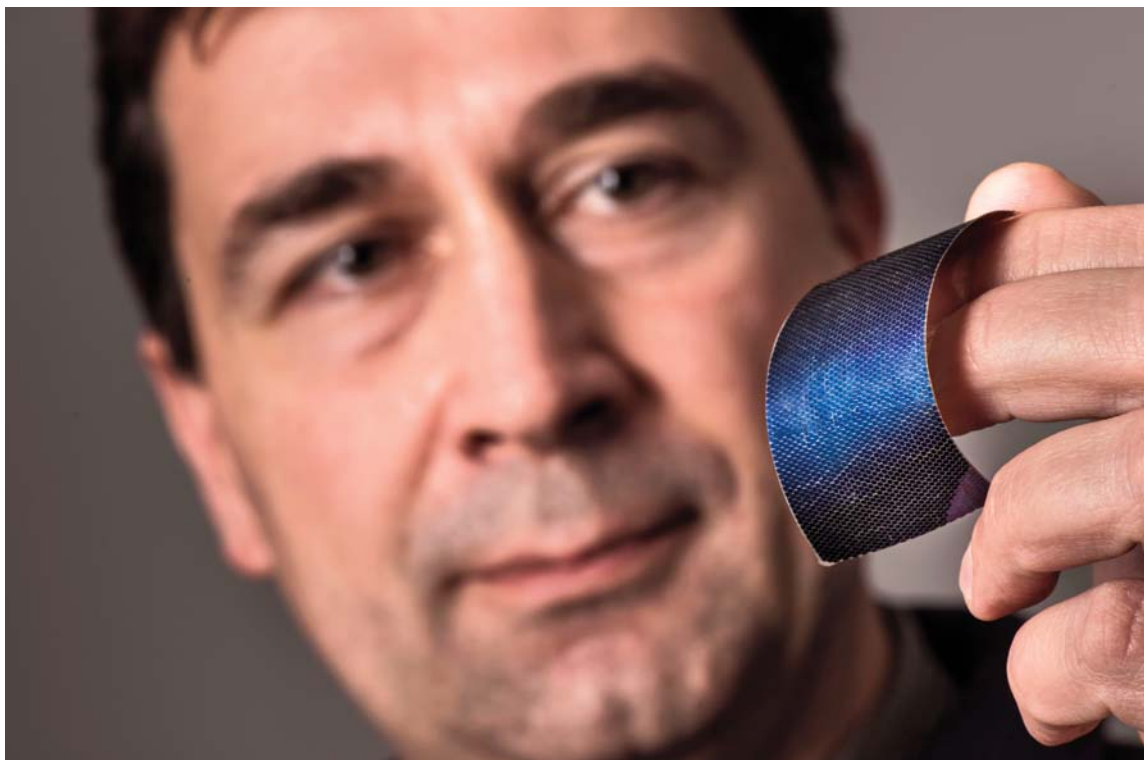
Sandia's solar glitter technology moves closer to market with new licensing agreement

By Nancy Salem

An Albuquerque company founded by a Sandia scientist-turned-entrepreneur has secured the rights to commercialize a Labs technology that could revolutionize the way solar energy is collected and used. A licensing agreement was signed Jan. 23 between mPower Technology Inc. and Sandia for microsystems enabled photovoltaics (MEPV).

"This is an important milestone," Murat Okandan, founder and chief executive officer of mPower, said at the signing. "It is an extremely exciting time in the solar industry with the upcoming critical, rapid change in the worldwide energy infrastructure. A lot of things are coming together and we're excited to be part of it."

Andy McIlroy, director of Research Strategy and Partnerships Center 1900 and deputy chief technology officer, said the license is special to Sandia because the technology is home grown. "To have it blossom in Albuquerque is something we can be proud of," he said. "We'd love to see it grow and become part of the country's solar-energy infrastructure."



SOLAR PRODUCT — Scientist Murat Okandan left Sandia to found mPower Technology Inc., whose primary product is Dragon SCALEs, small, lightweight, flexible solar cells that fit into and power devices or sensors of any shape or size. Okandan, who signed a licensing agreement with Sandia, shows a prototype here. (Photo by Randy Montoya)

Flexible, miniature solar cells

MEPV uses microdesign and microfabrication techniques to make miniature solar cells, also known as "solar glitter." mPower is commercializing MEPV as Dragon SCALEs, which are small, lightweight, flexible solar cells that fit into and power devices or sensors of any shape or size, including wearable ones. The high-efficiency cells can be integrated into satellites and drones, biomedical and consumer electronics, and can be folded like paper for easy transport.

Dragon SCALEs also make possible new shapes and materials and faster, cheaper installation of solar energy systems on buildings, Okandan says. The product offers higher voltage, greater reliability, and lower energy costs than standard silicon photovoltaic (PV) cells, he says.

"The key limitation to silicon is that if you bend and flex it, it will crack and shatter," he says. "Our technology makes it virtually unbreakable while keeping all the benefits of high-efficiency, high-reliability silicon PV. It allows us to integrate PV in ways that weren't possible before, such as in flexible materials, and deploy it faster in lighter-weight, larger-area modules."

Okandan says standard silicon PV operates with low voltage and high current at the cell and module level, which requires more silver or copper and adds cost. MEPV allows high-voltage and low-current configurations with less metal in the system and meshes well with integrated power electronics. "These are basic benefits that apply fundamentally to large-scale solar deployment," Okandan says. "And the same technology provides key advantages in satellites, drones, and portable power applications."

DOING BUSINESS — Industry Partnerships Senior Manager Mary Monson signs a licensing agreement with scientist-turned-entrepreneur Murat Okandan, center, and Research Strategy and Partnerships Director Andy McIlroy. Okandan left Sandia in 2015 through the Entrepreneurial Separation to Transfer Technology program and founded mPower Technology Inc. to commercialize Sandia's microsystems enabled photovoltaics, also known as solar glitter. (Photo by Jennifer Knight)

Left the Labs to start a company

Okandan, who helped develop MEPV while working at Sandia for 16 years, founded mPower after leaving the Labs in May 2015 through the Entrepreneurial Separation to Transfer Technology program, which lets Sandia employees go, with their jobs guaranteed for up to three years, to start or expand technology companies. Another former Sandian, Pete Atherton, joined mPower as chief operating officer after retiring last year.

Okandan says the cost of PV systems has dropped 70 percent in the past seven years and the number of installations has increased more than tenfold. "You can see that the momentum is there to deploy solar faster and more cost effectively," he says. "Our technology makes that even faster and lower cost by leveraging the massive silicon PV and microelectronics infrastructure and supply chain already in place."

The Sandia license will allow mPower to ramp up commercialization and attract more investment, Okandan says. The company has manufactured product prototypes that customers are evaluating. "We've been defining markets and partnerships," he says. "The license gives us the exclusivity to proceed with further business, product, and partnership development."

Licensing specialist Bob Westervelt (1932) says mPower used an exclusive license option on the MEPV technology in its initial product development and decided in October to convert it to a full commercial license that lets the company move to the next stage of its commercialization plan. He emphasized that the mPower license applies to a portion of Sandia's MEPV intellectual property portfolio associated with silicon solar cells. "There is other MEPV intellectual property useful for other applications and using other materials," Bob says. "That is still available for licensing."

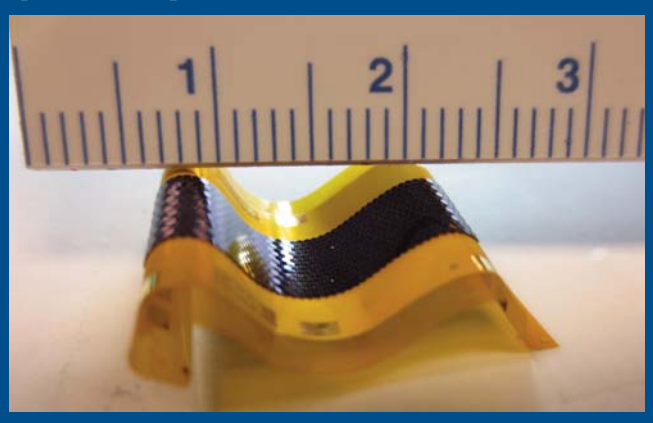
Mary Monson, senior manager of Industry Partnerships Dept. 1930, says companies like mPower take the Labs' technology and further develop it so it can be manufactured for widespread use in the energy and defense sectors. "Sandia's partnerships with industry play an integral role in our mission success," she says.

About microsystems-enabled photovoltaics (MEPV)

Researchers at Sandia National Laboratories are pioneering solar photovoltaic (PV) technologies that are cheaper to produce and easier to install than traditional grid power and capable of producing clean, safe, and reliable electricity. These innovations can help accelerate the growth of PV as a mainstream power source in the United States and globally.

One such innovation under development at Sandia is microsystems enabled photovoltaics (MEPV). MEPV concepts use microdesign and microfabrication techniques to produce miniaturized solar cells that are released into a solution similar to printing ink. This solution is then placed or 'printed' onto a low-cost substrate with embedded contacts and microlenses for focusing sunlight onto the cells. Sandia's approach uses cells that are tiny in both thickness and lateral dimensions – as small as 14 microns thick and 250 microns wide.

The thinness of the cells reduces material costs while enhancing cell performance by improving carrier collection and potentially achieving higher open circuit voltages. Sandia's microsystems enabled PV advances combine mature technology and tools currently used in microsystem production with groundbreaking advances in photovoltaic cell design, decreasing production and system costs while improving energy conversion efficiency. The technology has potential applications in buildings, houses, clothing, portable electronics, vehicles, and other contoured structures.



FLEXIBLE PHOTOVOLTAIC MODULE with the distance between curved peaks being measured. The ruler unit is in centimeters.

Sandian Jeff Tsao at Harvard explores social underpinnings of physical-science research

By Neal Singer

Jeff Tsao (1120), always interested in new ideas, has accepted a year-long, quarter-time position at the Harvard Kennedy School's Belfer Center's Science, Technology, and Public Policy program, where he is working with former Sandia VP Venky Narayanamurti on improving the processes and policies that aid good research.

In a jointly authored commentary in the November 2015 issues of *Physics Today,* the pair made the point that though hard-science researchers tended to look down upon the social sciences, they might be used to create guidelines that help researchers in the physical sciences chart a productive course between excessive caution or its opposite.

"As mathematicised, deep, and envied as are the physical sciences, research in them is just as much a social enterprise, and practiced just as much like an art or craft as is research in other sciences," they write. But they found that research teams that are highly successful seem to rely for direction only on the intuitive sense of their leaders, "without the analytical language or tool sets necessary to determine best practices, improve and replicate them, and share them with other research groups."

Jeff's aim, with Narayanamurti and others, is to use science to develop social guidelines to help keep hard-science research productive.

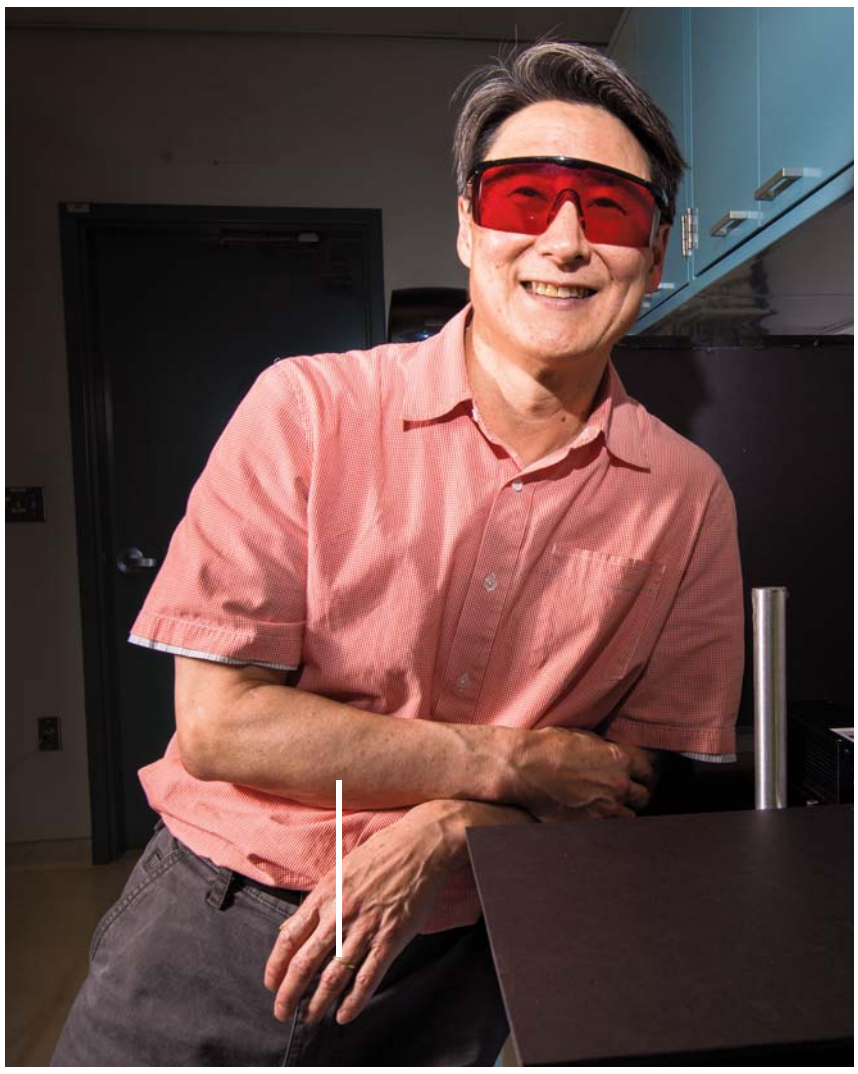
Jeff made an impression on the world mind in 2010 when he and coauthors published a paper that asserted the then-unusual thesis that widespread replacement of the Edison light bulb by LEDs might not lead to the generally expected "green" energy savings but rather, greater light emissions and therefore more productivity.

Narayanamurti went from his Sandia research VP position in the late 1980s and early 1990s to dean of Harvard's School of Engineering and Applied Science, which he founded. Now he is a former director of the Belfer Center program.

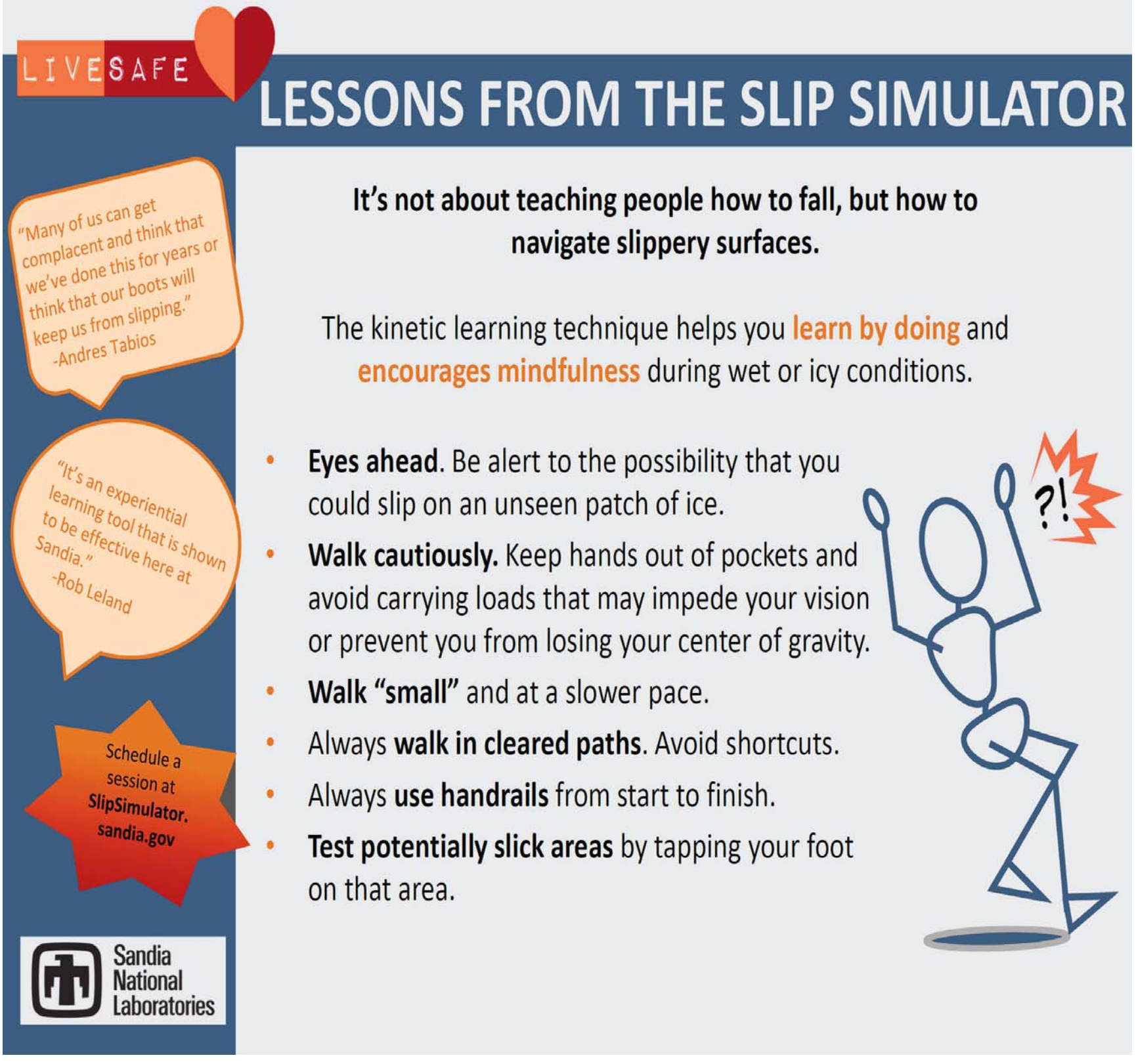
The Belfer Center has a keen interest in exploring the intersection of science and public policy. In 2015, it was ranked the No. 1 university-affiliated "think tank" in a University of Pennsylvania study. Its program fellows have gone on to fill key political positions, and include former US Secretary of Defense Ashton Carter, former US United Nations ambassador Samantha Power, and John Holdren, senior adviser to former President Barack Obama on science and technology.

"Sandia of course is one of our nation's premier R&D organizations," says Jeff. "My hope is that the work I do this year will ultimately inform how Sandia organizes its research activities for greater productivity and impact. Let's improve our understanding of how to invest our precious research funds as wisely as we can!"

Other papers are in progress.



SANDIA RESEARCHER Jeff Tsao. (Photo by Randy Montoya)



Mileposts

New Mexico photos by Michelle Fleming
California photos by Randy Wong


Ken Chavez
30 5414


Dennis King
30 6916


Yolanda Moreno
30 1911


Randolph Shibata
30 10247


Biu So
30 2955


Sandra Begay
25 6124


Richard Dramer
25 4824


Kristen Valdez
20 5943


Georgia Artery
15 427


Alexander Brown
15 1532


Pam Evans
15 5943


Terri Feldbusch
15 5403


Brad Gabel
15 5644


James Mulhall
15 1718


Prabal Nandy
15 5554


Brian Stoltzfus
15 1651


David Ther
15 2622

Recent Retirees

New Mexico photos by Michelle Fleming
California photos by Randy Wong


Russ Miller
40 8200


Bob Barton Jr.
40 10246


Bill Hendrick
39 4822


Larry Stevenson
39 2917


Christine Gutierrez
37 10595


Phil Hoover
37 2120


Jane Poppenger
37 5794


Roxie Salazar
36 5324


Mike Daniels
34 6813


Duane Garrison
34 9540


Jeffrey Danneels
32 6600


Ken Konopka
31 9514


Dave Cocain
30 2244


Bradley Smith
30 153


Pat Ortiz
27 4826


Rick De La Rosa
25 4843


Curtis Fox
25 4842


Mickey Fitzpatrick
18 3331


Ed Witzke
18 6523


Bob Miltenberger
15 4128


Sharon Martinez
14 4225


Rita Martinez
12 10667

Retiring and not seen in the *Lab News* pictures:

Ralph Cipriani (4856), 12 years.

SANDIA CLASSIFIED ADS

MISCELLANEOUS

'MOTOWN' TICKETS, 2, Popejoy, March 5, 6:30 p.m., great orchestra seats, east side, row P, inside aisle, $63 ea. Hoyal, 505-823-1421.

TREADMILL, power-fold, LED console, heart rate monitor, 12 programs, user profiles, commercial grade, excellent condition, $600. Rogers, 298-1928.

CHILDREN'S BOOKS, some condensed classics, several series; old AZ Highways & NM Magazines, free. Newcom, 505-293-5180.

CHRISTMAS PLATES, 8, by Sulamith Wülfing, 1985-1992, exquisite, boxes, certificate of authenticity, $60. Bickel, 822-0951.

TV ARMOIRE, dark stain, holds up to 39-in. TV, $100; Insignia LED HDTV, 22-in., w/wall mount, $50. Overholt, 505-250-7905.

MTD YARD MACHINES, 5.5-hp, chipper/shredder, 3-way system, excellent condition, $250. Lebien, 505-459-4074.

CRIB/CONVERTIBLE TODDLER BED, w/attached changing table & hamper, w/mattress, $100; rocking chair, w/rocking ottoman, $30. Gallegos, 505-259-6451.

DINING SET, Early American, dressers, Pottery Barn sofa table, antique table, Queen Anne chair, reasonable offers. Tapia, 280-8888.

DINING ROOM SET, Ethan Allen, 2 arm/6 side chairs, leaves & pads, $400. Shaw, 505-980-7491.

NAUTILUS NT-CC1 SMITH MACHINE, w/cable crossover, 470-lbs. of weights, plus extras, call for details, $600. Ludwigsen, 505-553-6231.

SMARTWATCHES, LG GizmoPal, 2 ea., used for 1 week, call for info, new $80, asking $60. Edmonds, 505-554-0578.

SANDIA 'LAB NEWS', from 1977 to present, in 3 boxes, bundled by year, take all, free. Buck, 209-403-7131.

REFRIGERATOR, Frigidaire, 25-cu. ft., white, side-by-side, 1-1/2 yrs. old, excellent condition, $750 OBO. Rodgers, 505-453-5530, ask for Melissa.

BOOKCASE, metal, Tennsco, 6 shelves, 34-1/2"W x 13-1/2" x 78"H, good condition, $200-$350 on Amazon, asking $50. Armstrong, 505-504-5554.

GIRL'S TWIN BDR. SET, 7-pc., white wood, $600; 4-pc. bdr. Set, queen, cherry wood, $700; photos available upon request. Kilbane, 715-7681.

SUPPORT FABULOUS FELINES WILD LOVE, win romantic Valentines' dinner pkg., www.fabulousfelines.org. Stubblefield, 263-3468.

POTTER WHEEL, electric, foot control, like new, professional quality, can handle large or small pcs., $365. Marron, 505-345-4006.

TRANSPORTATION

'94 TOYOTA CAMRY, 6-cyl., mechanic's special, needs new ECU, intermittent starting issue, $800 OBO. Sharp, 505-321-1757.

'15 CHRYSLER 200, all power, AM/FM/CD/AUX, 25K mostly highway miles, $13,500 OBO. Calzada, 505-401-0224.

'10 HONDA ACCORD, dark blue, clean, fuel efficient, 30K miles, $9,000. Trigueros, 928-315-1030.

'04 HONDA ODYSSEY EX, DVD, 221K miles, $2,650. Robertson, 505-407-4808.

'12 JEEP WRANGLER SPORT, removable hardtop, silver exterior, black interior, excellent condition, $20,000. Cover, 505-228-5337.

'09 TOYOTA YARIS, sedan, 5-spd. manual, 4-dr., silver exterior, charcoal interior, 46-mpg, new Pirelli tires, fluids replaced, 2nd owner, 78K miles, excellent condition, $6,250 OBO. Dwyer, 249-6935.

'14 RAM 1500, Laramie Long-Horn edition, V8 HEMI, white/gold, 4x4, leather, 43K miles, excellent condition, $36,500. de Luna, 210-800-4749, ask for Raul.

'12 DODGE RAM 1500 SPORT RT, HEMI, 4-in. lift, 61K miles, excellent condition, $29,500 OBO. Baca 505-301-7807.

'99 DODGE PICKUP, regular cab, LWB, 318 V8, AT, AC, 155K miles, runs well, $2,500. Gutierrez, 505-239-0010.

'08 MINI COOPER S, turbo charged, 6-spd. manual, panorama sun roof, heated seats, cold weather pkg., 68K miles, $8,500. Wartman, 505-400-5467.

How to submit classified ads

DEADLINE: Friday noon before week of publication unless changed by holiday.

Submit by one of these methods:

- **EMAIL: Michelle Fleming (classads@sandia.gov)**
- **FAX: 844-0645**
- **MAIL: MS 1468 (Dept. 3651)**
- **INTERNAL WEB: On internal web homepage, click on News Center, then on *Lab News* link, and then on the very top of *Lab News* homepage "Submit a Classified Ad."**

If you have questions, call Michelle at 844-4902.

Ad rules

1. Limit 18 words, including last name and home phone (If you include a web or e-mail address, it will count as two or three words, depending on length of the address.)
2. Include organization and full name with the ad submission.
3. Submit ad in writing. No phone-ins.
4. Type or print ad legibly; use accepted abbreviations.
5. One ad per issue.
6. We will not run the same ad more than twice.
7. No "for rent" ads except for employees on temporary assignment.
8. No commercial ads.
9. For active Sandia members of the workforce, retired Sandians, and DOE employees.
10. Housing listed for sale is available without regard to race, creed, color, or national origin.
11. Work Wanted ads limited to student-aged children of employees.
12. We reserve the right not to publish any ad that may be considered offensive or in bad taste.

RECREATION

'86 HONDA NIGHTHAWK, 450 cc, a classic, excellent condition, send email if interested, $1,700 OBO. Begeal, 505-881-4540, drbegeal@gmail.com.

THREE BIKES: Trek Y3, full suspension, $250; Cannondale F200, $175; Vertical XL2, all chrome, full suspension mountain bike, $100. Thurston, 918-0325.

'08 HONDA VTX1800 N, black, has hard bags, backrest, upgraded pipes, near perfect condition, $7,000 OBO. Widerkehr, 505-610-4906.

'08 HARLEY-DAVIDSON ROAD KING, 96ci, 6-spd., locking bags, cover, 46K miles, smooth & fast, $8,500. Mays, 505-440-2436.

REAL ESTATE

3-BDR. HOME, 2-1/2 baths, 2,096-sq. ft., lot size: 1.04 acres, FOB in Tijeras, $339,900. Redman, 505-506-7929.

3-BDR. HOME, 3 baths, 3,200-sq. ft., passive solar, 4-car garage/workshop, 1910-sq. ft., 1 AC, basement, views, close to Sandia, MLS#877252. Brothers, 505-296-5980.

WANTED

WORKING TREADMILL, weight bench, weight bar, good condition, reasonably priced or free, will pick up. North, 515-514-7878.

SKID STEER, used, wheeled preferred, w/ or w/o attachments, for use on mountain ranch. Menicucci, 505-235-8501.

PART-TIME NANNY, or nanny share, 3-4 days per wk., for 2 young children. Mabray, 505-280-0942, explorerabq@gmail.com.

Campione wins ACES Early Career Award

Salvatore Campione (1352) has been awarded the 2017 Applied Computational Electromagnetics Society (ACES) Early Career Award "for innovative contributions to the electromagnetic modeling of complex systems and structures, from microwave to optical frequencies."

SALVATORE CAMPIONE

The ACES Early Career Award is issued to honor achievements and contributions in the field of computational electromagnetics by a researcher aged 35 years or younger at the time of nomination. ACES provides a forum for issues relevant to numerical modeling in applied electromagnetics, with a focus on computational techniques, electromagnetics modeling software, and applications. A goal of the ACES community is to enhance electromagnetic computations by means of novel techniques, pushing the frontiers of what is possible.

A senior staff member, Salvatore's areas of expertise include electromagnetic theory, antennas, metamaterials, plasmonics in nanostructures, and optical devices.

He was named a Marconi Society Paul Baran Young Scholar while still a University of California Irvine (UCI) graduate student. Salvatore also received the 2016 Outstanding Young Professional award from the IEEE honor society Eta Kappa Nu (IEEE-HKN), and was selected as one of UCI's top 50 graduate and postdoctoral scholar alumni.

Salvatore will receive his award during a ceremony at the ACES 2017 annual symposium in Firenze, Italy, in March.

—Neal Singer

Still going strong

Dwight Soria celebrates 50+ years at Sandia

By Jules Bernstein

Who grows and grows at a company for 50-plus years? Can you name one person? Yes, you can. Dwight Soria (8545-1), 72, loves learning and loves variety — traits that are obvious to anyone looking at the long list of jobs he's held at Sandia, from HVAC mechanic to maintenance operations lead.

It's also obvious that Dwight loves being a Sandian. He has no plans to leave and says, "I'll be working here until they tell me: 'There's the door.'"

Those are words he is unlikely to hear.

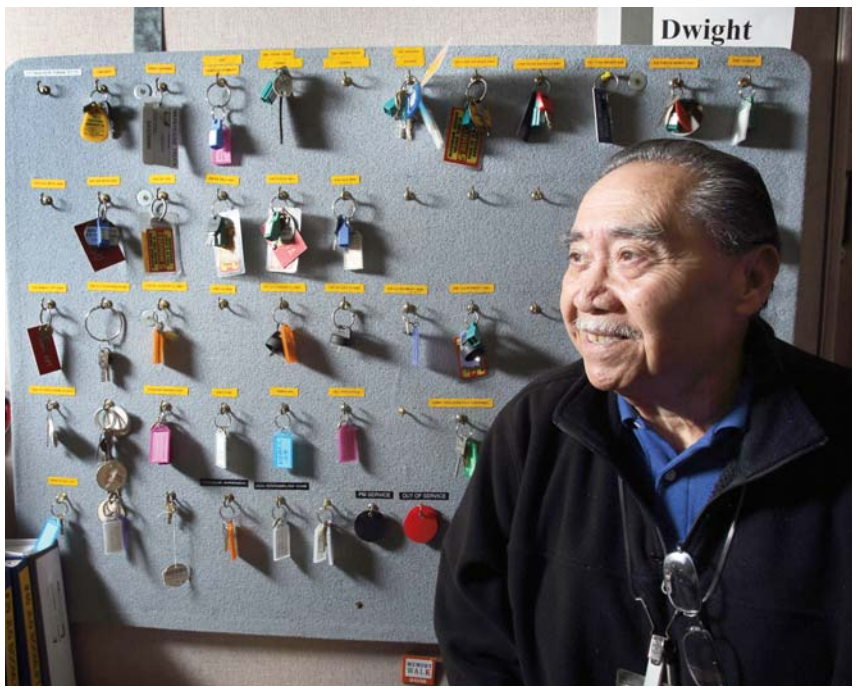
Craig Taylor (8545), Dwight's manager for the past decade, considers him a model employee. "Some people, when they do things a certain way for decades, get stuck in their ways. Not this guy. He gets top marks for positive attitude and mindset. He's exactly the person you want on your team," Craig says.

A Bay Area native, Dwight came to the Sandia/California site after five years as an Air Force flight mechanic. Looking for jobs, he asked a friend at Sandia about openings. He was told there weren't any, but Dwight applied anyway. He was hired as a trades helper in 1966, acting as an extra pair of hands for craftsmen.

In 1969, Dwight entered a Sandia-sponsored plumbing, air conditioning, and pipefitting apprenticeship program, which launched his 22 years as an HVAC mechanic. Next, he worked as a planner, scheduling preventive maintenance for facilities. This was followed by a new role as a maintenance operations lead, buying materials for repairs and upkeep on all campus buildings. Currently, Dwight serves as material management support.

Of the changes he's observed over the years, Dwight says he's most enjoyed watching the changes in technology — from electromechanical to digital and mechanical to centrifugal refrigeration systems, which are more reliable and have bigger capacity, but can occupy the same footprint.

One thing that will never be obsolete is Dwight's advice to newer staff seeking a career with the longevity he has enjoyed. "I tell young people to learn as much about their trade as they can," he says. "In school they teach you what you need to know to get your licenses. They don't necessarily teach you specialty skills. It's up to you to expand your knowledge base."



DWIGHT SORIA reflects back on his 50+ years with Sandia. (Photo by Dino Vournas)

He also has timeless advice for being an indispensable team member: "Don't be afraid to share your knowledge with other people. If you help them, they'll turn right around and help you," he says.

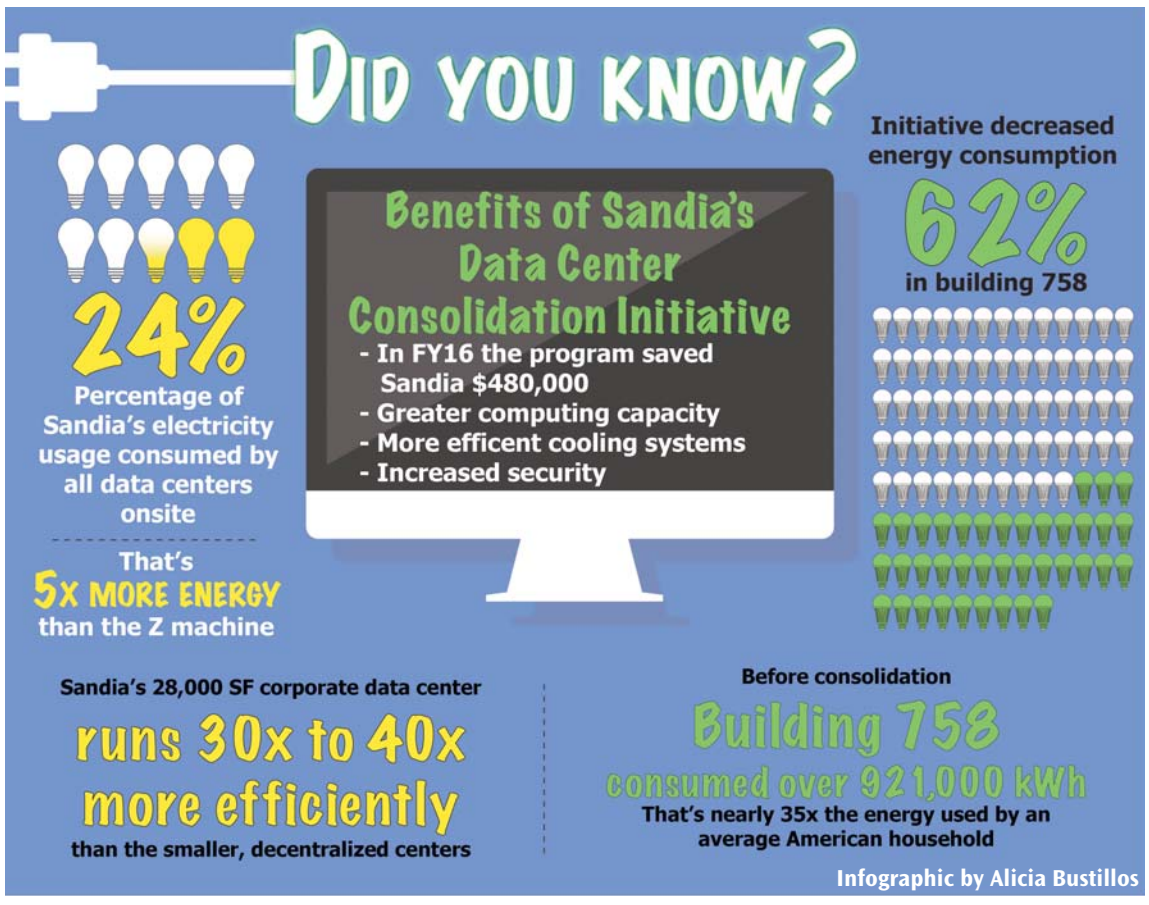
In addition to helping his colleagues, Dwight enjoys helping his granddaughters: 12-year-old twins Alyssa and Maia, and 9-year-old Ella. They'll all be his guests at the next Family Day.

If you see Dwight around the campus, congratulate him on his incredible achievements — and don't be shy about asking him for advice.

Saving energy at Sandia:

Labs' Data Center Consolidation Initiative

By Jennifer Sawayda
Photo by Alicia Bustillos



Infographic by Alicia Bustillos

What are the largest constant energy users at Sandia? Sandians might guess the Z machine or the 858 MESA fab and lab. Both answers would be wrong. Data centers are five times more energy-intensive than these facilities, using some 24 percent of total site electrical energy at Sandia.

In 2013, Sandia assembled a team to embark on the Data Center Consolidation Initiative (DCCI) in response to a government directive to promote the use of green information technology. Among the DCCI members are Sam Jones (9342), Tim Seigler (9324), Matt Trujillo (9324), Carol Meincke (4855), and Dave Martinez (9324).

According to Sam, project lead of the DCCI, "This five-year investment will increase the efficiency of Sandia data centers through an intentional and strategic consolidation effort."

A data center is any room with one or more servers that uses more than 20 kilowatts of energy. Data center consolidation involves decreasing an organization's IT footprint through the adoption of more efficient technologies. At Sandia this involves combining the equipment of smaller data centers into a larger, more efficient system.

The most notable case study in how data center consolidation reduces energy at the Labs is the Bldg. 758 project. The building, in Tech Area 1, is used to conduct work in monitoring systems and technology. In 2013, it consumed more than 921,000 kilowatt hours, nearly 35 times the energy of an average American household. Through data center consolidation, energy usage in the building decreased by 62 percent. "The change was so dramatic the information was double-checked to ensure the meter was working correctly," says Carol, the Facilities strategic planner for the DCCI team.

Sam points out that the benefits of data center consolidation extend beyond energy savings. "Consolidating data takes advantage of newer technologies to achieve both cost savings and greater computing capacity. We achieved energy savings and found a better way to do the computing portion because of evolving technologies. Basically, we are able to kill two birds with one stone."

Benefits of Data Center Consolidation

When examining smaller data centers across Sandia, the DCCI team works to determine whether equipment could operate more efficiently if placed in the corporate data center.

> *"Smaller data centers are often constructed in buildings never meant to support them, such as office buildings. Without the proper building efficiencies, more energy is lost and greater investments in equipment are required to cool the equipment."*
>
> **— Data Center Consolidation Initiative team member Carol Meincke**

"Smaller data centers are often constructed in buildings never meant to support them, such as office buildings," says Carol. "Without the proper building efficiencies, more energy is lost and greater investments in equipment are required to cool the equipment."

One unintended side effect of converting office spaces into data centers is the temperature fluctuations that occur from heat generated by the machines and the makeshift systems required to cool them down. Sam says employees in these buildings often suffer uncomfortably cold temperatures because the massive cooling units intended to cool machines are placed in buildings designed for people.

On the other hand, the 28,000-square-foot corporate data center is built to optimize efficiencies in energy use. Dave, engineering program/project lead for Infrastructure Computing Services, estimates the corporate data center runs 30 to 40 times more efficiently than the smaller ones scattered throughout Sandia.

Data center consolidation also increases security. Smaller data centers increase risks for data integrity as each center requires its own backup system.

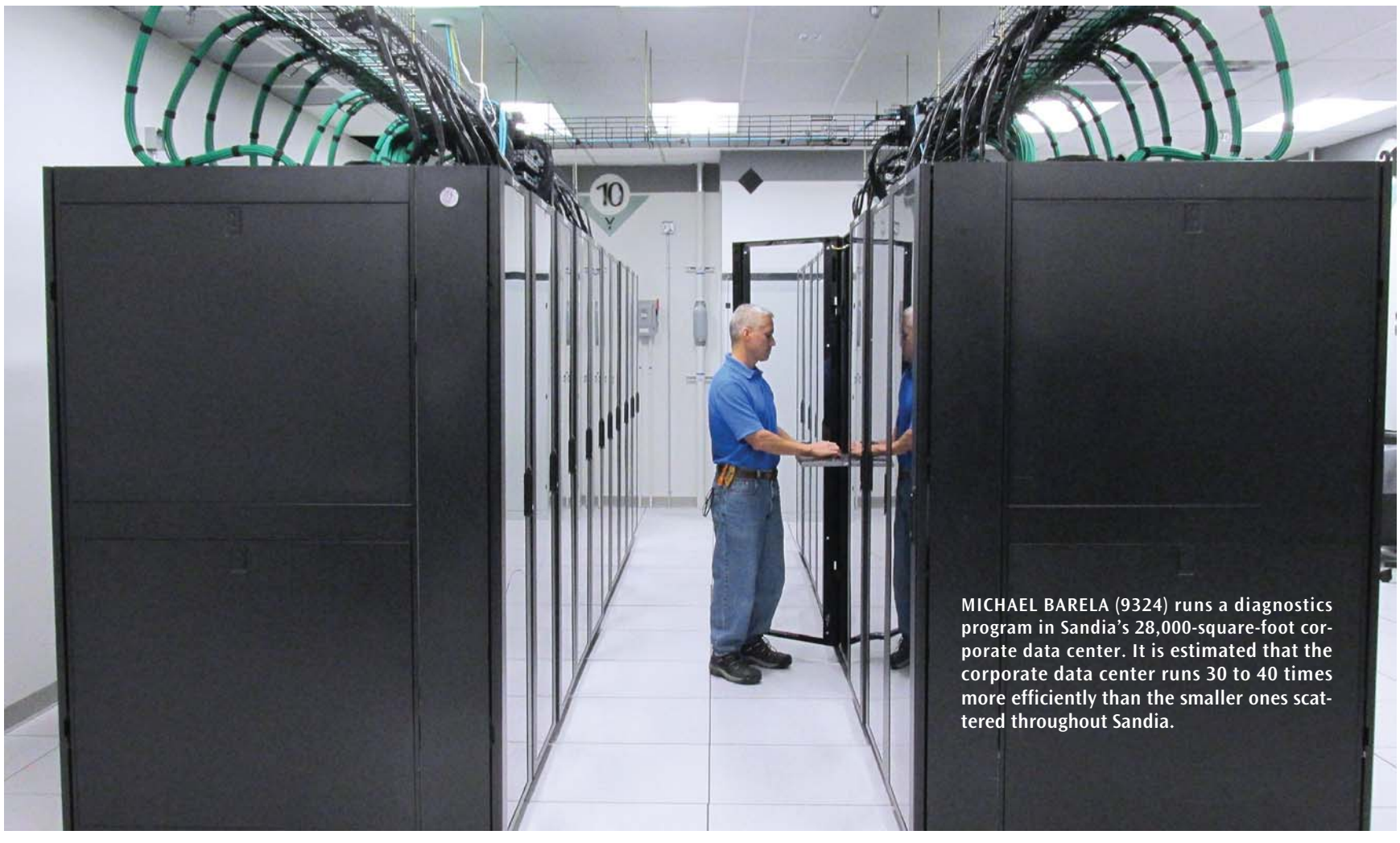
Constant support available

"At the corporate data center, strong backup systems and a full uninterrupted power supply prevent data loss in case of system failure. The corporate data center also has constant support available," says Dave.

The goal of DCCI is to consolidate smaller data centers that could be run more efficiently as one system. DCCI team members recognize that many people are reluctant to have their servers in different buildings, believing their data to be less secure. "However, we hope to create a paradigm shift in how consolidation is viewed," Dave says.

From energy savings to increased information security, data consolidation is a win-win, says Dave. To that end, the resulting cost savings earned the project team a first-place award in the Labs' Operational Innovation Program in the Cost Savings category. Data center consolidation saved Sandia $480,000 in FY16.

"We believe this is best business practice and evolution of where the technology is going," Sam says.



MICHAEL BARELA (9324) runs a diagnostics program in Sandia's 28,000-square-foot corporate data center. It is estimated that the corporate data center runs 30 to 40 times more efficiently than the smaller ones scattered throughout Sandia.