Sandia receives ENERGISE award to study how to help utilities better manage power systems

By Stephanie Holinka

Sandia has been awarded $2.5 million over three years to help utility companies better visualize, manage, and protect power systems as they include increasing numbers of distributed energy resources (DER) such as wind and solar.

The project creates open-source advanced distribution management system (ADMS) algorithms that help grid operators better assess the status and health of their power systems. The algorithms will be added to commercial management software to allow utilities to optimize distributed energy resources so they can better manage voltage fluctuations and protect the system from faults.

“The project will create the world’s first demonstration of an open-source, secure, resilient, optimization platform,” says principal investigator Jay Johnson (6112). “The algorithms aggregate field data like inverter data, data from smart meters, and industrial control (SCADA) data from utilities to generate an accurate picture of power players

By Sue Major Holmes

R esearcher Pylin Sarobol explains an elegant process for ultrafine-grained ceramic coatings in a somewhat inelegant way: submicron particles splatting onto a surface.

That splatting action is a key part of a Sandia project to lay down ceramic coatings kinetically. By making high-velocity submicron ceramic particles slam onto surfaces at room temperature, Pylin (1832) and her colleagues avoid the high temperatures otherwise required to process ceramics like alumina and barium titanate.

Coating at room temperature makes microelectronics design and fabrication more flexible and could someday lead to better, less expensive microelectronics components that underpin modern technology. The kinetic process produces nanocrystalline films that are very strong and could be used as protective coatings against wear, corrosion, oxidation, and the like.

Pylin says it’s difficult to consolidate ceramic coat-

(Continued on page 5)

PYLIN SAROBOL (1832) looks at samples of carbide coatings as she stands in front of a Sandia deposition chamber. Pylin and colleagues are working on a process to lay down ceramic coatings kinetically, avoiding the high temperatures that otherwise would be required. (Photo by Randy Montoya)

PYLIN SAROBOL (1832) looks at samples of carbide coatings as she stands in front of a Sandia deposition chamber. Pylin and colleagues are working on a process to lay down ceramic coatings kinetically, avoiding the high temperatures that otherwise would be required. (Photo by Randy Montoya)

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That’s that

Have you seen the teasers in the Sandia Daily News for the upcoming Shoe Box Challenge? The contest, part of the Lab’s observance of Engineer Week 2017, tasks self-selected teams, both technical and non-technical, to build something to be specified on Feb. 23 when shoe boxes are handed out. The teams can only use the parts in the shoe box and the thing to be built, whatever it is, must meet certain dimensional requirements.

According to the rules, the teams must complete the challenge on their own time before or after work. The project must be a team of six (the maximum allowable number of members) a couple of hours a night over the course of two or three evenings.

The teams’ entries will be judged on Feb. 23 in two categories, technical and creative, and winners will be announced immediately following the judging. As I write this, a full week before the registration deadline, more than 60 teams have already signed on, so clearly there is a lot of interest in this activity.

When I first saw the shoe box item about the challenge I was a bit skeptical. It initially struck me that this was a rather frivolous activity for a national laboratory. Isn’t this the kind of thing kids do as school projects? As I thought about it though, I began to see the brilliance of engaging our staff in this activity. It literally encourages out-of-the-box thinking — taking stuff out of a box and assembling it in novel ways. And besides, play may be one of the most serious things we do.

No less a thinker than Albert Einstein is famously quoted as saying, “Combinatorial play seems to be the essential feature in productive thought.”

Note that Dr. Einstein doesn’t say “an” essential feature; he says play is “the” essential feature. And physicist Richard Feynman, one of the great minds of the 20th century, said, “Play is hard to maintain as you get older. You get less playful. You shouldn’t, of course.”

On the subject, do you remember the ultimate Shoe Box Challenge, one for which the correct solution was literally a life-and-death matter? I’m talking about the incubator in Apollo 13 — and it happened in real life pretty much as it was shown in the movie — where the lunar module’s circular CO2 scrubber canisters were almost depleted and the square canisters used in the Command Module wouldn’t fit in the LM canisters’ round hole. Unless a solution was found, the three astronauts would die.

When the problem is explained to him, flight director Gene Kranz says, “Well, I still don’t see any reason why we can’t just cut down the square one and make it fit.”

The scene cuts to another office where technicians hurriedly dump onto a table the contents of several boxes containing the same equipment and tools that the astronauts have in space. The team lead says, “We’ve got to find a way to make this” — holding up a square CO2 canister — “fit into the hole for this” — holding up the round canister — “using nothing but that” — waving his hands toward the stuff on the table.

The team came through and the astronauts were saved, thanks in no small part to the fact that their standard onboard gear included rolls of duct tape. Without the tape, the clever fix may have been impossible. It’s incredibly versatile stuff. I can attest from experience that there’s a lot of truth in the observation by Clint Eastwood’s character, Walt Kowalski, in the movie Gran Torino: “Take these three items right here... WD-40, vise grips, and some duct tape. Any man worth his salt can do half the household chores with just those three things.” And maybe you’ve heard the old saying, “If it doesn’t move, and it shouldn’t, use duct tape.” That adage should, use WD-40. If it moves, and it shouldn’t, use duct tape.” That adage...and we’ve heard it.

I wonder if there’ll be any duct tape in that Sandia Shoe Box Challenge? Nah, that’d make things too easy.

See you next time.

— Bill Murphy (MS 1468, 505-845-0845, wtmurph@sandia.gov)
‘TourSandia’ without a badge

By Madeline Burchard

You no longer need a badge to visit Sandia, thanks to TourSandia, a collection of virtual tours that showcases the Labs' capabilities. Now anyone with an internet connection can visit eight locations from the Albuquerque and Livermore laboratories. No paperwork required.

TourSandia was designed to engage audiences of any background with Sandia’s important mission, unique work, and dedicated people. Visit TourSandia at tours.sandia.gov and share with your friends, family, and future Sandians.

By Jules Bernstein

Andrew Kosydar (8114) is demonstrating Sandia’s motto of “exceptional service in the national interest” by volunteering for a national project to help end homelessness.

Andrew is one of about 350 volunteers who canvassed the streets of Sacramento County on Jan. 25 for the annual Point-in-Time (PIT) count. “I believe those who are less fortunate deserve a helping hand, and this is one way I can extend that hand,” Andrew says.

The Department of Housing and Urban Development (HUD) requires an annual county-by-county tally of people who live in transitional housing or emergency shelters. A count of those without shelter occurs every other year. HUD uses this data to fund homeless prevention programs, supportive services, and housing programs nationwide. The data also is included in the Annual Homeless Assessment Report to Congress, which describes the overall scope of homelessness in America.

Results of the last PIT showed Sacramento City and County as having 2,659 people without safe, stable housing, including 948 who live without shelter of any kind. Results from every region nationwide are posted toward the end of the year on the HUD website. Care providers then are able to use this information to provide assistance that is targeted and more effective.

Canvasing for the PIT count is only one of Andrew’s volunteer activities. During graduate school in 2008, Andrew held a Boren Fellowship, which allowed him to volunteer activities. During graduate school in 2008, Andrew held a Boren Fellowship, which allowed him to live and study in Syria. The fellowship, administered by the National Security Education Program, offers students an opportunity to learn languages spoken in regions critical to US interests. Andrew now serves as a mentor for other program fellows, helping them explore career opportunities.

Andrew plans to continue providing exceptional service both at the lab and after work, and says he will participate in the PIT count when it happens again in January 2019. Should readers be inspired to follow Andrew’s lead, information for volunteering is available online.

Living the motto

Sandian provides ‘exceptional service’ by volunteering for homeless count

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Andrew Kosydar (8114) hitting the streets of Sacramento for the biennial homeless point-in-time count.
SANDIA RESEARCHER Jay Johnson was awarded funds from the DOE SunShot Initiative to implement algorithms to help utility companies better manage their distributed energy resources.

(Photo by Randy Montoya)

ENERGISE

(Continued from page 1)

how the whole system is doing. With that information, the ADMS can adjust the behaviors of individual devices to make the whole system more efficient and safe.”

The project is principally focused on making a lot of small devices, like microinverters on rooftop photovoltaic installations, work together to solve specific problems with high penetrations of renewables. To mitigate the voltage fluctuations from DERs, utilities currently can either add expensive voltage regulators to manage the swings, or they can have the DER devices themselves do that job, Jay explained.

By intelligently controlling DER functionality, Jay says, utilities can increase the deployment of variable generation without the need to purchase and install voltage regulators.

Sandia’s “Voltage Regulation and Protection Assurance using DER Advanced Grid Functions” project was selected for funding under the Enabling Extreme Real-Time Grid Integration of Solar Energy (ENERGISE) program through DOE’s SunShot Initiative.

Data from DERs also increases operator situational awareness.

“Being able to see the whole system at a glance is increasingly important because, as a greater percentage of power on the grid comes from distributed resources, there can be greater swings in voltage,” Jay says. “Most utilities do not have real-time, customer-level voltage information available to them right now.”

Partners on the project include the Georgia Institute of Technology, BPL Global, the National Grid, and Public Service Company of New Mexico (PNM).

The software algorithms developed by Sandia in partnership with Georgia Tech will be put into a commercial software package and will first be validated and refined at Sandia’s Distributed Energy Testing Laboratory (DETL). As part of the project, Sandia will collaborate with a major national solar company to strengthen its cybersecurity posture by applying Sandia’s Information Design Assurance Red Team (IDART) tools on an emulation of a system control network. The results of this work will be released as industry best practices and used as the starting point for a new DER cybersecurity working group being launched with this project.

In the third year of the project, the DER management software will be deployed at PNM and the National Grid utility installation in the Northeast.

When finished, the software will be released as an open-source product via an online repository for the source code created by SunSpec Alliance, a trade group for solar energy companies.

The DOE SunShot Initiative is a national effort to drive down the cost of solar electricity and support solar adoption. SunShot aims to make solar energy a low-cost electricity source for all Americans through research and development efforts in collaboration with public and private partners.

The Sunshot Initiative funds programs that reduce the cost of solar across residential, commercial, and utility-scale photovoltaics (PV) as well as concentrating solar power.

SUNSHOT 2020 GOALS

In 2011, the SunShot Initiative was launched and set a goal to lower the levelized cost of solar electricity in order achieve cost parity with conventional electricity sources by 2020. Those goals are:

- $0.09 per kilowatt hour for residential solar
- $0.07 per kilowatt hour for commercial solar
- $0.06 per kilowatt hour for utility-scale solar

The goals and the impacts on the industry were discussed in depth in the SunShot Vision Study, which used models developed at the National Renewable Energy Laboratory to analyze and predict solar market growth.

As of November 2016 — five years into the program — the solar industry is already more than 90 percent of its way toward achieving Sunshot’s utility-scale goal and has also seen significant cost reductions in residential and commercial solar.

Learn more about progress to the 2020 goals and opportunities ahead in the On the Path to Sunshot report series at goo.gl/vJtq1Z.

Sunshot Initiative on target for 2020 goals

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SUNSHOT 2030 GOALS

As the solar industry made rapid progress toward the 2020 targets, Sunshot doubled down and committed to a further goal: to cut the cost of solar electricity an additional 50 percent between 2020 and 2030. These goals are:

- $0.05 per kilowatt hour for residential PV
- $0.04 per kilowatt hour for commercial PV
- $0.03 per kilowatt hour for utility-scale PV

These goals are discussed in depth in the SunShot Initiative 2030 Goals Paper. Beyond these cost targets, Sunshot is working to advance grid-integration approaches in order to enable two-way power flow, increase demand response, and optimize electric vehicle charging. Such advances in combination with low-cost battery storage could enable economically competitive solar to be widely deployed across the country while also facilitating greater integration of other renewable power sources.

Sunshot is also addressing market barriers that limit solar adoption, including streamlining processes to reduce project time cycles, expanding access to solar, and accurately representing solar’s value in a more integrated energy system.
Using kinetics, not temperature, to make ceramic coatings

(Continued from page 1)

ings and similar hard materials and then integrate them into devices with materials that have relatively low melting temperatures. Because ceramic components are processed at temperatures of about 1,300 degrees Celsius (700 degrees Fahrenheit or more), it can be difficult to combine them with certain materials that have particular functions within electrical and mechanical devices. For example, current miniature waveguides require micro-machining out a tiny piece of electromagnetic material and gluing it onto another material.

“The ability to put down ceramics at room temperature means you can process ceramics and lower-melting temperature materials at the same time,” says Pylin, who leads the project, now in its second year. “You can now put ceramics on copper, for example. Before, you had to make the ceramics first, then put the copper down on it. This process is really about being able to integrate materials, especially ceramics, with other materials.”

It opens up new possibilities for fabrication — electrical circuits combining hybrid materials or tiny capacitors. “Plastic deformation of functional materials onto a circuit board rather than high-temperature processing, followed by tedious manual assembly,” Pylin says.

Kinetic energy takes advantage of materials properties

Rather than heat, aerosol deposition uses kinetic energy and special material properties found at micro- and nanoscales. There’s still much to learn about the process.

“We really need to spend the time to understand the process parameters, how they relate to the resulting microstructures, and to the final material properties that we need,” Pylin says. “When we think about designing a new device, we need to keep the relationship of structure-processing-properties in mind and allow ourselves time to perform the research, the optimization, and understand how we can make the properties of coatings better.”

Room-temperature microwave coatings won’t be a panacea, however, because the process produces nanocrystalline structures — not ideal for applications such as micro-actuators, micro-motors or capacitors that need large grain structure for better device function, she says.

“The aerosol deposited coatings are made up of tiny, 20-nanometer crystals that we often call crystallites or grains,” Pylin says. “When we heat our coatings, these tiny crystals grow and the properties change. By controlling the crystallite size, we can tune the properties in predictable ways to make more functional devices” for different applications.

There are only a few places in the US that work on such room-temperature kinetic coating processes. Pylin’s initial research came as principal investigator for a two-year Army Career Laboratory (Director’s Research and Development project, “Room Temperature Solid State Deposition of Ceramics,” that ended last March. It led to better understanding of the basic building blocks of coatings and the scientific fundamentals behind the process.

Next comes optimizing the process, expanding the materials that can be fabricated, and developing them for potential applications, which could take years.

In a nutshell, this is how it works: In aerosol deposition, a nozzle accelerates submicron particles suspended in a gas toward the surface. Particles impact and stick, building up a coating layer by layer. A key is to use submicron particles, 50 times smaller than the diameter of a human hair, that allow researchers to tap into materials properties found only at small scales and activate plastic deformation in the aerosol particulate layer. Plastic deformation, a way to cause a substance to permanently change size or shape under applied stress, it’s the plasticity of submicron particles that causes consolidation of subsequent deposition layers and generates the continuous surface that layers are built upon.

Another key is that deposition in a vacuum, which helps alleviate the effects of reflected gases on the flying particles. Reflection of the high-velocity carrier gas from the deposition substrate can create so-called bow shock, a gas boundary layer that’s difficult for the smallest of particles to penetrate. But in a vacuum, reflected gases are diffused so the bow shock layer is thinner. The smaller particles traveling fast have high momentum and can get through the thin bow shock layer. Without a vacuum, the bow shock layer is large and particles don’t have enough momentum to penetrate the substrate.

Plastic deformation critical to process

Maintaining the particle kinetic energy through the bow shock layer is critical to achieve material plastic deformation, and without plastic deformation there’s no sticking and no coating.

When a particle impacts the substrate or another layer, it plastically deforms and changes shape by a process known as dislocation nucleation and slip. Pylin’s team discovered particles have nanofeatures that make them “lay down onto a substrate like splattering cookie dough, forming a pancake-shaped grain.”

The next particle that hits and deforms tamps down the original layer, creating an even tighter bond so “you have both the materials deformation or shape change and fracturing without fragmentation, and finally the tamping from subsequent particles to help.”

Those mechanisms make many layers possible, building up coatings that are tens of microns thick. “We have made nickel coatings as thick as 68 microns, and in literature I’ve seen reports of up to about 80 microns for ceramics,” Pylin says.

Team members have successfully deposited multiple materials using the method, including copper, nickel, aluminum oxide, titanium dioxide, barium titanate, and carbonate compounds. Likely applications for this short list of materials alone include capacitors, resistors, inductors, electronic contacts, and wear surfaces.

An enticing application specific to barium titanate films is electric field managed systems. High-voltage capacitors, for example, are prone to failure where the dielectric material (barium titanate) meets the copper electrode and air, creating a three-material junction.

“If you spray on barium titanate at this junction, you can develop quite the possibility of higher power capacitors,” Pylin says. “There’s much more to do before we achieve good enough properties for that.”

Other researchers are interested in electrical contacts, protective coatings, or consolidating brittle and intermetallic compounds for the first time.

The process also spans the microwave gap between two established technologies, thin films and thermal spray technology. Thin films are coating layers, ranging in size from nanometers to a few microns, that can be defined into precision electrical circuits and are patterned via photolithography techniques instead of traditional printed circuit boards. Thermal spray technology can produce coatings starting at about 50 microns up to a few centimeters.

“This can bridge that missing gap, where you can start to deposit hundreds of nanometers of materials up to a hundred microns,” Pylin says.

The team includes postdoctoral appointee Andrew Vackel, student intern Jesse Adamczyk, and technologist Tom Holmes, augmented by Materials Characterization and Performance Dept. 1819 and experts in 1814, 1816, 1851, 1111, and 1132.
Energy in the marketplace

Sandia takes home two national tech transfer awards

By Nancy Salem

Sandia won the Federal Laboratory Consortium’s (FLC) national 2017 Award for Excellence in Technology Transfer for a heat exchanger technology that makes power generation more efficient. And Sandia won the FLC’s State and Local Economic Development Award for Excellence in Technology Transfer for its work on the New Jersey TRANSITGRID project.

The Technology Transfer award honours employees of FLC member laboratories and non-laboratory staff who accomplished outstanding work while transferring federally developed technology. The Economic Development award recognizes successful partnerships between state or local groups and federal laboratories that benefit the economy.

Judging of the nominations is done by a panel of experts from industry, state and local government, academia, and the federal laboratory system.

“Sandia is honored to be recognized by our peers for our work in technology transfer,” says Jodie Kerbs Moore, manager of Technology and Economic Development Dept. 1933 and the Labs’ representative to the FLC. “These awards are meaningful because they show Sandia at its best, working with groundbreaking technology to solve problems of a national scale and create economic competitiveness for US businesses.”

Heat-transfer efficiency

The micro-channel heat exchanger (MCHX) is a technology that makes power generation, refrigeration, heating, and gas processing more efficient. In power generation, even small increases in heat transfer efficiency can greatly boost production and cut the cost of electricity.

Demand for industrial MCHEs has outstripped supply. Until recently, just one company — based outside the US — has done large-scale production of industrial MCHEs. A domestic supplier could reduce costs and increase supply and energy efficiency in a variety of uses.

Sandia’s Selection, Evaluation, and Rating of Compact Heat Exchangers, or SEARCH, is a software suite used to design efficient MCHEs. The design requires a combination of analytical performance estimation, computational fluid dynamics, and finite element modeling, with each cycle taking from hours to days. Sandia’s simplified design tool uses a sub-heat exchanger thermodynamic model, American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code mechanical constraints, and a thermal-hydraulic solver within the Engineering Equation Solver platform to model any combination of liquid, gas, two-phase, and supercritical fluid.

VPE, Vacuum Process Engineering (VPE), is a US manufacturer of heat exchanger systems. VPE has used SEARCH to commercialize the technology, and licensed it to Sacramento, California, company, which has used it to reach international quality standards, including ASME Boiler and Pressure Vessel Code certification, and enter the MCHX market as a domestic original equipment manufacturer. VPE produces MCHEs in the US and sells them domestically and internationally.

“Sandia implemented a fast-paced project plan while constantly adapting to changing market forces faced by VPE. … [this partnership with VPE has been] essential to making this happen, and the FLC award shows we are committed to creating real and immediate value for our partners.”

— Matt Carlson, Sandia PI on SEARCH

Reliable transportation power

Following a series of storms that shut down transit systems and damaged properties that culminated in the Superstorm Sandy in 2012, New Jersey Transit Corp. (NJT) sought ways to reduce its vulnerability to power outages caused by natural or manmade disasters. In 2013, NJT signed a Memorandum of Understanding (MOU) to work for a solution with Sandia, DOE, and the New Jersey Board of Public Utilities. Sandia was brought in due to its microgrid research and development work for more than 20 US military bases.

NJT’s rail service operates between the job centers of New York and New Jersey, and is the largest statewide public transit system in the country, covering a service area of 5,325 square miles and serving almost 900,000 passengers daily.

Sandia’s partnership with NJT focused on the Energy Surety Microgrid (ESM) developed at Sandia about 15 years ago. The Labs did a feasibility study under the MOU and, after an initial design was completed, New Jersey was awarded $410 million from the Department of Transportation to develop NJ TRANSITGRID, a first-of-its-kind electric microgrid for transportation that can supply highly reliable power during storms or other times when the centralized power grid is compromised.

With DOT funding in place, Sandia began working with NJT on a CRADA valued at more than $1 million to develop the TRANSITGRID. The proposed system would include a central, natural gas power plant and transmission lines to power substations that electrically tracks and operating controls on portions of the NJT and Amtrak systems. The facility would operate 24/7 and incorporate distributed energy, renewable energy, and other technologies to provide reliable power to key NJT stations, maintenance facilities, bus garages, and other buildings.

“This innovative partnership between Sandia and NJT will lead to the first critical civilian infrastructures design methodology developed for military installations and will help identify and address challenges to the widespread deployment of microgrids, including regulatory compliance,” says Robert Bederick, NJT’s current principal investigator on the project.

When completed, NJ TRANSITGRID will be one of the largest microgrids by capacity and geographical footprint in the US and a model to guide applications of resilient microgrids to other critical infrastructure.

“Sandia successfully applied microgrid design methods and tools that were developed as part of DOE and Department of Defense programs, primarily for military and high security infrastructure. In many ways, the project is even more challenging because it involves multiple states, jurisdictions, agencies, and complex legal issues.”

— Abe Ellis, manager, Photovoltaic and Distributed Systems

By Fevrier Demery

“The NJ TRANSITGRID project is a large-scale microgrid specifically designed to improve resilience of critical infrastructure, rail transportation service in this case,” says Abraham Ellis, manager of Photovoltaic and Distributed Systems Dept. 6112 and previous principal investigator on the project. “Sandia successfully applied microgrid design methods and tools that were developed as part of DOE and Department of Defense programs, primarily for military and high security infrastructure. In many ways, the project is even more challenging because it involves multiple states, jurisdictions, agencies, and complex legal issues.”

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The FLC is a nationwide network of about 300 members that provides a forum to develop strategies and opportunities for linking laboratory mission technologies and expertise with the marketplace. The awards program annually recognizes federal laboratories and their industry partners for outstanding technology transfer efforts and has become one of the most prestigious honors in technology transfer. Since its establishment in 1984, the FLC has presented awards to more than 200 federal laboratories.

“SEARCH and New Jersey Transit are great examples of how Sandia’s scientific research translates into products that benefit the public, and at the same time enable our missions,” says Mary Hinson, senior manager of Industry Partnerships Dep. 1930. “These partnerships are impor-tant to Sandia’s contributions in energy security, reliability, and efficiency. We look forward to engaging with additional partners to make these and other innovations more widely available.”
TMS honors Sandia computational materials researcher Stephen Foiles

By Sue Major Holmes

TMS has honored Stephen Foiles of Sandia’s Computational Materials and Data Science department with its 2017 Cyril Stanley Smith Award, presented for outstanding contributions to the science and technology of materials structure.

He will receive the award March 1 in San Diego during the 146th annual meeting of TMS, the Minerals, Metals & Materials Society.

“Cyril Smith was a very cool person, a sort of a Renaissance man, one of those names you recognize. To get an award named after someone of that stature is humbling,” says Stephen (1851).

His manager, Amy Sun, says Stephen is well respected by his Sandia colleagues. “His expertise in grain boundary dynamics has broad applications ranging from understanding fundamental mechanisms of part failures to quantifying the impact of strength in metals with impurities,” she says. “Stephen always has a way of articulating complex, atomistic scale physics to concepts that engineers can relate to. I am not surprised that Stephen’s work is equally influential external to Sandia, and he is the perfect candidate for this well-deserved distinction.”

Stephen has worked for Sandia since 1983. He spent the first 17 years of his career with Sandia/California before moving to Sandia/New Mexico. He is a co-recipie-ent of the 2016 Journal of Materials: Science: Cahn Prize with Christopher O’Brien (821) and is a Fellow of the Institute of Physics and the American Physical Society. While working in California, he and two Sandia colleagues — Murray Dow, now at Clemson University, and Mike Banks, now at Mississippi State University — developed what’s now the standard formula for how atoms interact in simulations of metals. His contribu- tions to the development of the atomic-scale simula-tions include both molecular dynamics and Monte Carlo methods, most notably in the development of inter-atomistic potentials that underlie those methods.

Work revolutionized the field of atomistic simulations

Corbett Battaille (1814), who along with Brad Boyce (1851) nominated Stephen, says Stephen and his collabor-ators developed the Embedded Atom Method in the mid-1980s for simulating the properties of metals at the atomic scale. “That approach revolutionized the field of atomistic simulations, and it’s still used extensively today,” Corbett says, adding that Stephen has used that and other methods to make major contributions to understanding the properties and behaviors of interfaces and defects in materials. Stephen’s years of work on the structure, thermody-namics, and mechanical properties of grain boundaries also have attracted interest. His recent studies of defects in metals and semiconductors focus on the variability of interfacial properties, including external conditions such as temperature and alloy composition.

The research has been funded by the DOE’s Office of Basic Energy Sciences, Division of Materials Research; DOE’s Advanced Simulation and Computing Program; and various Labo-ratory Directed Research and Development projects. TMS, with headquarters in Pittsburgh, Pennsylvania, has nearly 13,000 members working in minerals, metals, and materials science from minerals processing and primary metals production to research and advanced applications.

Award named in honor of metallurgy pioneer

Cyril Stanley Smith, for whom the prestigious TMS award is named, was a British metallurgist and historian of science. He is most famous for his work on the Manhattan Project where he was responsible for the production of fiss-ionable metals. A gradu-ate of the University of Birmingham and Man-chaets Institute of Tech-nology (MIT), Smith worked for many years as a research metallurgist at the American Brass Com-pany. During World War II he worked in the Chemical-Metallurgical Division of the Los Alamos Laboratory, where he purified, cast, and shaped uranium-235 and plutonium, a metal hitherto available only in microgram amounts, and whose properties were largely unknown. After the war he served on the Atomic Energy Commission’s influential General Advisory Committee, and the President’s Science Advisory Committee.

Smith founded the Institute for the Study of Metals at the University of Chicago, the first inter-disciplinary academic organization devoted to the study of metals in the United States. He studied the details of faults and grain boundaries in met-als, and developed theoretical models of them. In 1967, he moved to MIT as an Institute Professor with appointments in both the departments of Humanities and Metallurgy. He applied the tech-niques of metallurgy to the study of the produc-tion methods used to create artifacts such as samurai swords. — Source: Wikipedia
By Neal Singer

The team of student intern Julian A. Vigil and mentor Tim Lambert (both 6124) has won a 2017 American Chemical Society (ACS) Division of Inorganic Chemistry Award for Undergraduate Research. Julian will receive a financial stipend and a plaque; Tim will receive a plaque for permanent display at Sandia.

Julian's research career began as a junior in high school, when he participated in an eight-week student-intern research program with Tim. During that Sandia program, called STAR (Science, Technology, And Research), Julian quickly learned to perform rotating-disk electrode studies. His results were significant enough to make him a co-author with Tim and a university professor on Julian's first paper, submitted that summer and published Oct. 9, 2013. Since then, Julian has repaid Tim's continued interest in his progress not only by mentioning newer students but by contributing to and then leading the development of a number of promising nanoscale inorganic electrocatalysts for oxygen electrochemistry and/or water-splitting. In addition to serving as models to understand the process of catalysis in systems of interest, Julian's materials also have the potentiality and hence are potentially a more cost-effective solution than the precious metals that are the current commercial standards.

Note: Why is change so hard? originally appeared 2/7/17 in the internal NW Blog (https://prod.sandia.gov/nwblog). All Sandians with access to the internal Techweb can view the blog, which serves as a communications tool to deliver periodic information on a wide variety of Weapons program-relevant topics, with a focus on the NW Program Management Unit, as well as executing line organizations. Email nwcomm@sandia.gov to offer topic suggestions, feedback, author ideas, etc.

By Elizabeth Roll
Sr. Administrator, Dept. 10654

Why is change so hard?
Our brains aren't made for it

I suspect that most of us are having, or hearing, sentiments of this nature. Why are we prone to anxiety and worry in the face of change? Unfortunately, our brains aren't made for it. Our brains crave certainty, and one way we find certainty is through pattern-matching. When our minds receive information, we go into our bank of past experiences and compare them to the current situation. Often, we can find a match and figure out how to proceed. When there's a circumstance without any clear corollary, especially like the one we're experiencing with the contract change, it's hard to find a good match to make us feel comfortable with what's happening and what might be the outcome.

When we experience the uncertainty of change, our limbic system (the source of our fight or flight response) gets stimulated. Then, our brains start preparing for it. Our brains crave certainty, and one way to achieve it is by engaging the default mode network (DMN), a set of brain areas that respond to external stimuli. When our brains are engaged in the DMN, we tend to focus on the past and future, rather than the present moment.

In contrast, when we're in the functional mode network (FMN), we focus on the present moment. This helps us to respond to challenges and changes in a more effective way. Our brains aren't made for it, but we can reframe our perception of change to make it easier to handle.

Approach

Reinterpret—Decide the change is no longer a threat.

 Normalize—Recognize that uncertainty is going to cause stress, and that's normal.

Reordering—Identify which of your primary values are being challenged by the change, and determine which secondary values may be more useful to you.

Repositioning—Seek other perspectives to inform and help you look at the situation.

Sandia Application

How might the new contract be an opportunity to pursue the things you've always wished were different about Sandia?

Consider using our Sandia value of learning as a shift in focus from a value you believe is threatened. What might we learn from this transition and the new leadership team?

When our brains are engaged in the DMN, we tend to focus on the past and future, rather than the present moment. This helps us to respond to challenges and changes in a more effective way.

In order to help ourselves, we can use techniques such as mindfulness meditation or muscle relaxation techniques. These techniques help us to stay focused on the present moment and keep our minds from getting overwhelmed by the stress of change.

Reframing perception does not come naturally and is hard to do alone. I recommend seeking out a trusted colleague and talking through these questions. Managers may want to try out these questions with their teams. Teams may want to discuss both the upside and downside of the upcoming contract change. Finally, different people have different perspectives. Seek out someone outside your usual circle of interaction and see how they're framing the contract change.

Change is hard because our brains aren't made for it. But by reframing, we can offer the brain one thing it likes: choice in the face of uncertainty. This can help our limbic system calm down and make change not quite so hard.
MISCELLANEOUS

- SIMPLE ADDITIONS DISHES
- SKI RACK, Yakima, 15-in.
- EXERCISE BIKE, CardioMax
- MOVING SALE, great prices
- DESK, white, laminate, TEMA
- MISCELLANEOUS

CRSI, lobby
CGSC, lobby
Bldg. 701, next to elevator
Bldg. 823, lobby
Bldg. 836, lobby
Bldg. 891, lobby
Bldg. 894, east entrance,
Bldg. 892, lobby
Bldg. 880, Aisle D, north
Bldg. 822, south entrance
Bldg. 810, east lobby
Bldg. 802, elevator lobby

Garnier, 505-269-3350.
can email photo, $100.
serving stands, ~17 pcs.,
keys, w/Velcro carrier case,
~175 cm long, never used, 2
function, pack-down size, 75
$80. Lorence, 237-1205.
sidecut, cable bindings,
bound, 170 cm, 90-70-80
good condition, $50.
round or aero clamps,
stationary, upright, all steel,
Rodgers, 573-356-8914.
tureBright Sun Touch Plus,
moving.sale.abq17@gmail.
https://goo.gl/R9dZTA.
like new items,
ing cabinet, $85. DuBay,
New Mexico photos by
California photos by
Michelle Fleming
Ireena Erteza, a 2017 Asian American Engineer of the Year honoree, is a distinguished member of the technical staff. “In synthetic aperture radar, her work has significantly changed the way the community approaches SAR signal processing,” says her manager. (Photo by Randy Montoya)

IREENA ERTEZA, a 2017 Asian American Engineer of the Year honoree, is a distinguished member of the technical staff. “In synthetic aperture radar, her work has significantly changed the way the community approaches SAR signal processing,” says her manager. (Photo by Randy Montoya)

Ireena Erteza (5962) has engineering in her blood. She’s had a love for it as far back as she can remember. “My father showed me what it is to be a scholar and an engineer,” she says. “He was playful and creative. He gave me free rein to play in his workshop and to do projects alone or with him. We spent many hours working on cars, plumbing, lawn mowers, mopeds, computers, modern... everything. He made me want to explore and excel in many diverse areas.”

By Lindsey Kibler

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About AAEOY

AAEOY stands for Asian American Engineer of the Year, an annual national awards program that recognizes the most distinguished professionals for their leadership, technical achievements, and remarkable public service. As a part of the National Engineers Week (DiscoverE) program, AAEOY was introduced in 2002. This event has since become a prestigious and important forum for corporate America, academia, and government organizations to promote STEM (science, technology, engineering, and mathematics) activities. Past AAEOY honorees have included Nobel laureates, academic researchers, key corporate executives, and astronauts.

Besides recognizing outstanding Asian American engineers and scientists from across the country, special Distinguished awards celebrate the achievements of Asian Americans for their global stature and influence. Those awardees have served as role models and a source of inspiration for the STEM community as a whole. Many internationally known individuals have received these Distinguished awards at AAEOY events since 2002.

Asian American engineer sees prestigious award as ‘career achievement’

AAEOY

Ireena, an electrical engineer, has been named a 2017 Asian American Engineer of the Year (AAEOY). She will be honored in a ceremony Feb. 24 in Bellevue, Washington. She is the third woman from Sandia to receive the prestigious award since the program began in 2002.

The AAEOY awards program, celebrated each year during National Engineers’ Week, is sponsored by the Chinese Institute of Engineers USA to salute Asian American professionals in science, technology, engineering, and math who demonstrate exceptional leadership, technical achievements, and public service. Fifteen Sandia engineers have earned an AAEOY title, and other past winners include astronauts, corporate executives, and Nobel laureates. Nominees come from a range of industrial, academic, government, and scientific institutions.

“I am very honored and humbled to receive this prestigious award as I start my 25th year at Sandia. It serves as recognition for the significance of my work — a career achievement award, in a sense,” says Ireena. “Sandia has been a wonderful place for me to work and grow, providing me with incredibly interesting problems that also have a tremendous impact to the nation.”

An all-around engineer

Ireena joined the Labs in 1993, after finishing her doctorate in electrical engineering at Stanford University. Early in her career, she worked in the areas of integrated and diffractive optics and information systems. She subsequently developed expertise in radiation effects on optical processing systems, unattended ground sensor signal processing, synthetic aperture radar (SAR) signal processing and algorithm development, and high performance computing. Her biggest impact has been to national SAR systems.

“Preossu is known throughout the lab and the nation for her technical contributions and her strong leadership. While having deep technical knowledge in her areas of expertise, Ireena also has an amazing ability to see the big picture, allowing her to guide the community forward strategically. In SAR, her work has significantly changed the way the community approaches SAR signal processing,” says her manager Larry Stotts (5962).

Her career has been marked by innovative research efforts in computation and algorithm development, initiatives to standardize radar data formats, and work to make interaction with computational power easy and accessible to users. “Her contributions have been game-changing, allowing the value and power of SAR to be applied to tactically relevant mission timelines. Her work has brought success to Sandia and its customers,” Larry adds, “and she continues to introduce fundamentally new concepts.”

Born into engineering

In the late 1940s, Ireena’s father came to the United States to attend graduate school. He and his wife emigrated from East Pakistan — known today as Bangladesh — and eventually settled in New Mexico, where he was a key faculty member in the electrical engineering department at the University of New Mexico (UNM). Ireena’s father never let gender affect her access to engineering; he had no doubts his daughter could become an accomplished scientist or engineer. She earned a Bachelor of Science from UNM and a Master of Science and PhD from Stanford, all in electrical engineering.

While studying at Stanford, Ireena met two role models who have mentored her long after graduation. One was her PhD adviser, professor Joseph Goodman. “He is an exemplar of a great scholar and great leader. He has always been an amazing advocate for me and for all of his students.” The other was fellow doctoral student, Brian Bray; he and Ireena have been married for 26 years. They are both distinguished members of the technical staff. The couple have one daughter, who is majoring in electrical engineering at Stanford.

Sheryl Sandberg, chief operating officer of Facebook, has often said that the most important career choice you’ll make is who you marry,” Ireena says. “Brian has always encouraged and enabled me to pursue my dreams, and he has constantly inspired me to keep growing.”

Mentee to mentor

For the past 30 years, Ireena has worked to be a strong role model for women pursuing science and engineering careers. She also has mentored in the community for more than 25 years, including early career engineers at the Labs. She is a member of Sandia’s recruiting and student intern programs. “As current professionals, we must make both work and non-work environments comfortable and welcoming,” says Ireena.

In addition to STEM-focused mentoring, she has a passion for running and, 18 years ago, started a trail running group. Every Sunday the group meets to run trails in the Sandia Mountains, the foothills, or around the city. “The mission of the group is to provide an encouraging environment for novice runners and a comfortable environment for more experienced runners to enjoy the amazing natural trails in Albuquerque.”

Ireena has participated and placed in dozens of local and national races, and she has been a nationally ranked novice racquetball player. A healthy work-life balance has contributed to her successes, and she strives to share that with those she mentors.

“Engineering is such a wonderful and fulfilling field, and I hope I can be a role model not only for young women but for all young people. It’s important for them to understand that success as an engineer doesn’t depend on gender or ethnicity,” she says.

“Sandia has been a wonderful place for me to work and grow, providing me with incredibly interesting problems that also have a tremendous impact to the nation.”

— Ireena Erteza

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